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EFFICIENCY OF EXPERIMENTAL SECURITY MARKETS WITH INSIDER INFORMATION: AN APPLICATION OF RATIONAL EXPECTATIONS MODELS

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Preliminary Draft

SOCIAL SCIENCE WORKING PAPER 331

July 1980

Revised August 1980

ABSTRACT

The study reports on the applicability of competing models of market information integration and dissemination in explaining the behavior of simple laboratory, one-period security markets. Returns to the security depended upon a randomly chosen state of nature. Some agents (insiders), whose identity was unknown to other agents, knew the state before the markets opened. With replication of market conditions a model based upon rational expectations principles is relatively accurate. Prices adjusted immediately to near rational expectations prices; profits of insiders were virtually indistinguishable from noninsiders; and efficiency levels converged to near 100 percent.

about the returns are immediately reflected in market price. Thus, according to these models, prices adjust instantaneously to equilibrium price levels which reflect at least "all available" information about the state of nature and in the case of the "crystal ball" hypothesis the equilibrium may reflect even more information than the sum of what is available to individual participants.

Differences among some models turn on the role played by price itself in conveying information about the state of nature. On one hand are rational expectations equilibria which adhere to the principle that prices in equilibrium must be consistent with the expectations individuals have about the state of nature when they face those prices. Thus, individuals infer the state of nature (up to a probability) from the price and that inference must be consistent with their experience and their own actions. On the other hand are the prior information equilibria which hold that individuals do not condition expectations upon price. Instead, expectations are exogenous to the price formation process with individuals utilizing whatever prior information they might have at their disposal. With expectations formed, prices are determined by a straightforward application of the principles of demand and supply.

We cannot claim that we have "tested" any of these models. All models are accompanied by technical assumptions and qualifications which are not present in the markets we created. Of course, some of the technical assumptions are for "convenience" while others are "critical" but, prior to applying the model to an empirical context, it is impossible to determine how assumptions should be partitioned into the two categories.

Thus, we are attempting a less ambitious task of determining the relative applicability of the competing models within simple (relative to the U.S. securities market) laboratory markets which have many of the features of markets which motivated the development of the models. It is our hope that by studying models which can be successfully applied to simple markets we can ascertain features of models which will ultimately have successful applications to the complex markets. Furthermore, models which are being advocated as general, with the advocates prepared to relegate all the "technical" assumptions to the "as if" categories or the "convenience" categories, should be expected to work in the simple special cases such as our laboratory markets.

In the sections below we report on five markets. Our experimental design reflects both our initial expectations and what we learned after the first market experiment. At first our expectations leaned in favor of the prior information equilibrium model as opposed to the rational expectations model. The results of the first experiment suggested that any market designed to discredit the rational expectations ideas must involve sufficient opportunity for experience. The second market was designed to give the rational expectations model a "best chance" relative to the prior information equilibria. The design of the second market was simplified by giving agents experience with the system when all agents had complete information prior to the insider information cases and by reducing the number of subjective states of nature as opposed to objective states so that the necessary replication could take place

within the available time. The rational expectations model performed well with prices and allocations converging close to the "perfectly informed" equilibrium. The next two markets involved replications without the experience with the certainty case, and the final market 5 involved an increase in the number of states from two to three as a check on the model. It continued to predict well.

The paper is developed as follows. In section two the markets and parameters are discussed. In section three our hypotheses are stated clearly and in section four they are reviewed in light of the results. In section five some of the implications of the analysis are reviewed in light of current mathematical models and the statistical models applied to the United States securities industry. The last section is a summary of conclusions. Details of experimental procedures which are the heart of the markets are outlined in Appendix A.

II. LABORATORY MARKETS

Each market experiment involved several periods. In each period securities which had one-period lives were bought and sold. Each security paid a single dividend to the holder at the end of the period for which the security existed. The dividend returns from security holdings differed across individuals (which could be analogous to different tax brackets or risk preferences) and depended upon the (randomly drawn) state of nature. Differences in dividends and possibly expectations led to the existence of gains from exchange and market activity. The markets were organized as oral double auctions[1] similar to those on the floor of the New York Stock Exchange.

Subjects were students at the Graduate School of Business at the University of Chicago. In markets 1, 2, and 4 all subjects were inexperienced in that none had previously participated in a laboratory market. Subjects in markets 3 and 5 were experienced since they were drawn from the participants of the earlier market experiments.

Individual preferences were created by an application of induced value theory (Smith 1976, and Plott 1979). Each individual subject, i, was assigned a dollar redemption function of the form:

$$R_i^t = \gamma_i[a_i + d_i(\theta_t)x_i^t + \sum_s p_s^{it} - \sum_p p_p^{it} + c_i^t],$$

$$a_i < 0,\ d_i(\theta) > 0,\ \gamma_i > 0,\ x_i^t \geq 0.$$

R_i^t = dollar earnings of individual i in period t.

x_i^t = units held by i at the end of period t (all short sales were prohibited so $x_i^t \geq 0$), is the sum of initial endowment of securities plus purchases less sales in period t.

$d_i(\theta)$ = dividend rate in francs for individual i and expressed as a function of the state of nature θ.

$\sum_s p_s^{it}$ = revenue from sales of securities during period t.

$\sum_p p_p^{it}$ = cost of securities purchased during period t.

$\theta \in \Omega$ = possible states of nature.

c_i^t = initial endowment of cash in francs.

a_i = fixed cost in francs.

γ_i = conversion rate of francs into dollars.

As long as an individual has a positive utility for money, (s)he would like R_i^t as large as is possible. This motivation systematically induces values on the securities by virtue of derived demand theory. Such values

can then be used as parameters on market models.

As is implicit in the formula above, at the beginning of each period each individual was given an initial endowment of working capital (C_i^t) which was sufficiently large to never serve as a binding constraint on purchases of securities. Each individual was also given an initial endowment of securities ($\bar{x}_i^t$) at the beginning of each period. Since short sales were never permitted except as a reduction of an individual's initial endowment, there was a fixed supply of securities, $\sum_i \bar{x}_i^t$.

The initial endowment in the form of working capital and securities was frequently of substantial value. Since these amounted to a payment to the individual each period, a fixed cost each period, $a_i < 0$, was imposed to reduce the cost of the experiment.

All trading was in francs. Use of francs allows flexibility in the choice of parameters while avoiding the technical problems inherent in using large levels of dollars. Francs have been successfully employed in other experiments (Friedman 1967; Forsythe, Palfrey, and Plott 1980).

A key variable in these market experiments is the pattern of information. Since dividends depend upon the state of nature, security prices should be influenced by what agents know about the state. In these markets some agents (the insiders) were informed about the state of nature before trading began while others (termed "uninformed agents") were not. In market 1 insiders' knowledge about the state was less than certain while in markets 2 through 5 insiders were certain about the state.

Information about the state of nature is termed <u>prior information</u>. All individuals were aware of the mechanism for determining the state of

nature. In the absence of further information the prior information was characterized by their knowledge of the state-generating process which we will call prior probabilities for convenience (the magnitudes are listed in Figure 1).[2]

Prior information in addition to prior probabilities was given to some agents during some periods. At the beginning of each period a "clue card" was given to each agent. The card could be blank or it could contain a "clue." This mechanism allowed additional information about the state to be transferred privately to subsets of the agents before any trading took place.

The case where all individuals had only their prior probabilities is called the "no information" case. As shown on Figure 1 the first few periods of every market (the first four in 1, the first four in 2, the first two in 3, the first four and the last in 4, and the first three in 5) were conducted under the "no information" condition. This condition served as both a training period and a period of "calibration" for experimental purposes as will be discussed below.

During a few periods of market 1 (periods 9, 10, 11), market 2 (periods 5, 6), and market 3 (periods 11, 12) all individuals were informed about the state. As shown on Figure 1, during these periods everyone had the same "clue" in market 1 and everyone knew the state with certainty in markets 2 and 3. These were included as checks and controls. In market 2 the case of complete information was conducted in order to let agents learn about the price/state correspondence prior to their conducting operations in less informed environments. After observing the results we suspected that this type of training was unnecessary for the successful application of rational

FIGURE 1

INFORMATION DESIGN

Market No.	Prior Prob. of X	Knowledge about Others' Dividends	Period	Number of Informed Agents	Precision of Information	Correlation of Info. across Investors	Common Knowledge about Informed Agents: How Many	Who	What Informed Know	Information Held by Informed Agents: Info. on Card	Posterior Prob(X)	Actual State
1	1/3	None	1	None	Imperfect (a sequence of ten clues)		Yes(0)		Yes	No card	1/3	Y
			2	None			Yes(0)		Yes	No card	1/3	Y
			3	None			Yes(0)		Yes	No card	1/3	X
			4	None			Yes(0)		Yes	No card	1/3	Y
			5	3-one of each type		Perfect	No	No	Yes	0100101010	0.15	Y
			6	3-one of each type		Perfect	No	No	Yes	0000000011	0.555	X
			7	3-one of each type		Perfect	No	No	Yes	0100110100	0.15	Y
			8	3-one of each type		Perfect	No	No	Yes	0000010000	0.77	Y
			9	All		Perfect	No	No	Yes	1110000011	0.062	Y
			10	All		Perfect	No	No	Yes	1010000011	0.15	X
			11	All		Perfect	Yes	Yes	Identical	1111111001	0.003	Y
2	1/3	None	1	None			Yes(0)		Yes	No Card	1/3	X
			2	None			Yes(0)		Yes	No Card	1/3	X
			3	None			Yes(0)		Yes	No Card	1/3	Y
			4	None			Yes(0)		Yes	Y	0	Y
			5	All			No	No	Yes	Y	0	Y
			6	All			No	No	Yes	Y	0	Y
			7	6-two of each type	Perfect	Perfect	No	No	Yes	X	1	X
			8	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
			9	6-two of each type	Perfect	Perfect	No	No	Yes	X	1	X
			10	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
			11	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
3	0.4	Different investors may have different dividends	1	None			No	No	Yes	None	0.4	Y
			2	None			No	No	Yes	None	0.4	Y
			3	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
			4	6-two of each type	Perfect	Perfect	No	No	Yes	X	1	X
			5	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
			6	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
			7	6-two of each type	Perfect	Perfect	No	No	Yes	X	1	X
			8	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
			9	6-two of each type	Perfect	Perfect	No	No	Yes	X	1	X
			10	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
			11	All			No	No	Yes	Y	0	Y
			12	All			No	No	Yes	X	1	X
4	0.4	Different investors may have different dividends	1	None			No	No	Yes	None	0.4	X
			2	None			No	No	Yes	None	0.4	Y
			3	None			No	No	Yes	None	0.4	Y
			4	None			No	No	Yes	None	0.4	X
			5	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
			6	6-two of each type	Perfect	Perfect	No	No	Yes	X	1	X
			7	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
			8	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
			9	6-two of each type	Perfect	Perfect	No	No	Yes	X	1	X
			10	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
			11	6-two of each type	Perfect	Perfect	No	No	Yes	X	1	X
			12	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0	Y
			13	6-two of each type	Perfect	Perfect	No	No	Yes	X	1	X
			14	None			No	No	Yes	Y	0	Y
5	P(X)=.35 P(Y)=.25 P(Z)=.4	Different investors may have different dividends									Posterior Prob. X Y Z	
			1	None			Yes(0)		Yes	No Card	.35 .25 .40	Z
			2	None			Yes(0)		Yes	No card	.35 .25 .40	X
			3	None			Yes(0)		Yes	No card	.35 .25 .40	Z
			4	6-two of each type	Perfect	Perfect	No	No	Yes	X	1 0 0	X
			5	6-two of each type	Perfect	Perfect	No	No	Yes	X	1 0 0	X
			6	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0 1 0	Y
			7	6-two of each type	Perfect	Perfect	No	No	Yes	Z	0 0 1	Z
			8	6-two of each type	Perfect	Perfect	No	No	Yes	Z	0 0 1	Z
			9	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0 1 0	Y
			10	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0 1 0	Y
			11	6-two of each type	Perfect	Perfect	No	No	Yes	X	1 0 0	X
			12	6-two of each type	Perfect	Perfect	No	No	Yes	Y	0 1 0	Y
			13	6-two of each type	Perfect	Perfect	No	No	Yes	Z	0 0 1	Z

expectations models so dropped it from the next and then subsequent market experiments.

In all remaining periods of all markets only a subset of the agents received information about the realized state of nature. The design, as displayed in Figure 1, has a subset of agents from each dividend type (preference type) receiving information about states in addition to the prior information. This allows a comparison of the behavior of the "insiders," those with additional information, with noninsiders, those with only prior information. In all markets exactly half of the agents of each type (two of four) were "insiders." In market 1 there was only one (out of three) insider of each dividend type.

Information received by insiders was different in market 1, so it is discussed separately. In market 1, starting with period 5, three individuals, one of each type (the insiders), were given a "clue" about the state of nature. This "clue" was a sample of ten draws with replacement. The sample was taken from urn X containing balls marked "O" and "I" ($pr(O|X) = 4/5$, $pr(I|X) = 1/5$) if the state randomly chosen was X and the sample was drawn from urn Y ($pr(O|Y) = 3/5$, $pr(I|Y) = 2/5$) if the randomly chosen state was Y. The samples given the three insiders is shown in column 9 of Figure 1 together with the Bayesian posterior probabilities of the state, given the sample. If the insiders were perfect Bayesians, then their subjective probabilities of the state, given the information they received, would be those in the figure.

The results of market 1 suggested that the markets would adjust to the general pattern of information in the market. But some replications may be necessary for each information pattern before equilibrium is finally established for that information pattern.

A reduction in the number of different information patterns would thus result in a reduction of periods necessary to see equilibrating behavior should it exist. In all markets after market 1 (periods 5 through 11 in market 2, 3 through 12 in market 3, and so forth) the information contained on the "clue card" received by the insiders indicated the realized state of the nature with certainty.

Information that everyone knows publicly (as opposed to privately) is called common knowledge (Aumann 1976). Since the instructions were read publicly, each agent knew what other agents had obtained from that source of information. In particular, every agent knew that no one knew how many and who the insiders were. The exceptions are periods 1 through 4 of market 1, periods 1 through 4 of market 2, periods 1 through 3 of market 5 in all of which the fact that no one had any information was announced and also in period 11 of market 1 in which the clue was publicly announced. Additional common knowledge of possible importance was that the clues of all insiders were identical. From the nature of the instructions agents could deduce in all but market 1 that the allocation to agent types remained constant during the experiment and that the dividend values for every type remained constant. Agents did not know the number of agent types although in markets 3, 4, and 5 they were told that the dividends of others may differ from their own (in 1 and 2 nothing was said) and they did not know that the insiders were the same agents throughout the relevant periods.

The dividend parameters for all markets are summarized in Figure 2. Agents in each experiment were partitioned into three types

FIGURE 2

DIVIDEND PARAMETERS

ALL MARKETS

Market	Investor Type	No. of Investors	Initial Endowment: Certificate	Initial Endowment: Francs	Fixed Cost	Dollar per Franc	Dividends: X	Dividends: Y	Dividends: Z	Prior Probability: X	Prior Probability: Y	Prior Probability: Z	Expected Dividend
	I	3	2	10,000	10,000		150	350					283.3
1	II	3	2	10,000	10,000	0.002	250	300		1/3	2/3		283.3
	III	3	2	10,000	10,000		300	100					166.7
	I	4	2	10,000	10,000		100	350					266.7
2	II	4	2	10,000	10,000	0.002	200	300		1/3	2/3		266.7
	III	4	2	10,000	10,000		240	175					196.6
	I	4	2	10,000	10,000		400	100					220
3	II	4	2	10,000	10,000	0.003	300	150		0.4	0.6		210
	III	4	2	10,000	10,000		125	175					155
	I	4	2	10,000	10,000		375	100					210
4	II	4	2	10,000	10,000	0.003	275	150		0.4	0.6		200
	III	4	2	10,000	10,000		100	175					145
	I	4	2	10,000	10,000		120	170	320				212.5
5	II	4	2	10,000	10,000	0.003	155	245	135	0.35	0.25	0.4	169.5
	III	4	2	10,000	10,000		180	100	160				152

(designated as I, II, III) according to dividend returns. There were four agents of each type except in market 1 where there were three. This provided markets with twelve agents except market 1 in which there were nine. Each period each agent had an initial endowment of two certificates giving a market supply of twenty-four units (eighteen for market 1). In addition, each period each agent was given 10,000 francs in working capital which was returned to the experimenter at the end of the period by the imposition of a fixed cost of 10,000 francs. The conversion rates of dollars per franc are on the table.

Dividends were paid on each security held at the end of the period. The dividends differed by agent type and according to the state of nature. Reading Figure 2 we can see that in market 1 there are two possible states, X and Y. An agent of type I receives 150 francs for every certificate held if the state is X and 350 francs per certificate if the state is Y. The dividends for other types and other markets are determined similarly. For example, in market 5 there are three possible states (X, Y, and Z) and an agent of type I receives dividends per certificate of 120, 170, or 320 depending upon whether the state is X, Y, or Z.

The prior probabilities of states are in the ninth column. These and the dividends were chosen so that the prices and allocations predicted by competing models would reasonably be separated. The final column gives the expected value of a certificate for a given type of agent based on the prior probabilities.

III. MODELS

We focus on two competing ideas. The first is the prior information equilibrium hypothesis and the second is the rational expectations equilibrium hypothesis. For completeness, however, a third set of three models will be mentioned.

The prior information equilibrium hypothesis has been the traditional vehicle for incorporating uncertainty into market and other economic models. Each individual, i, is provided with endowment of securities, $\bar{x}_i$, a priori information, $p^i(\theta)$ about the state of nature θ. Demand functions, $x_i = D^i(p,\bar{x}_i)$ are then generated from the theory that individuals attempt to

$$\max_{x_i} \sum_{\theta} u^i(x_i,\theta)p^i(\theta) \quad \text{subject to} \quad p(x_i - \bar{x}_i) = 0.$$

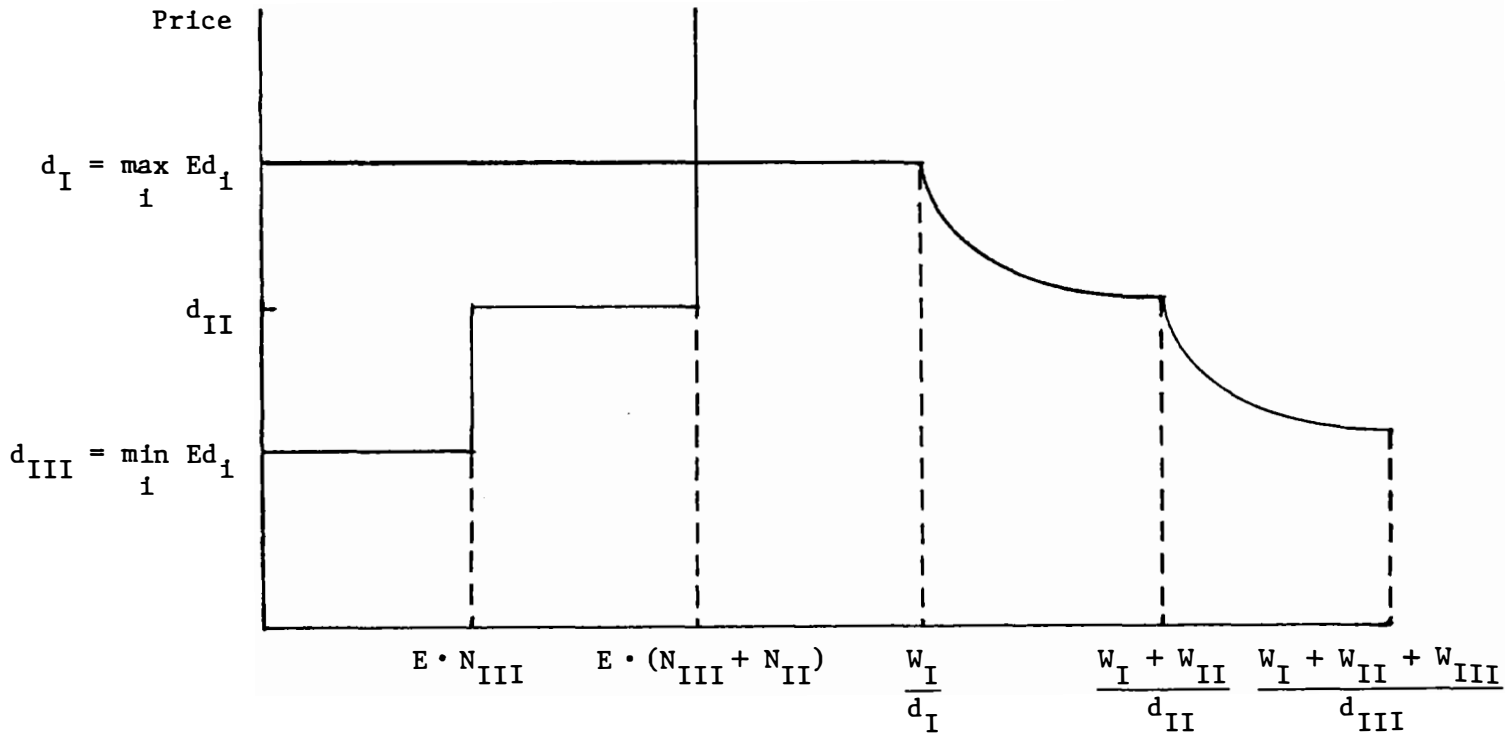
Prices are determined by the law of supply and demand

$$\sum_i D^i(p,\bar{x}_i) - \sum_i \bar{x}_i = 0.$$

For the market settings and parameters described for the experiments above the application of this model is straightforward. In the absence of risk aversion, at any price below the expected dividend value, agents will demand as many units as their working capital will buy. At prices above the expected dividend value, agents will sell the two units initially endowed and would sell more if short sales were permitted. Market demand will thus be "horizontal" until the capital constraint becomes binding as shown on Figure 3 and the

FIGURE 3

SUPPLY AND DEMAND FUNCTIONS



W_i = initial working capital of investors of type i.

N_i = number of agents in the market of dividend type i.

E = initial endowment of securities per agent.

d_i = dividend of agents of dividend type i.

demand price will equal the expected dividend value of the agent type with the maximum expected dividend. Supply is limited by the initial endowments.

The predictions of this model for various states and information conditions imposed across all experiments are summarized in Figure 4. These figures are simply taken from Figure 2 by determining the type of agent with the maximum expected value. The model predicts both price and final allocations. For example, in market 2 the price will be 266 in state X because uninformed individuals of both types I and II have an expected value of 266. All other agents have lower expected values and should thus sell to these four agents who have a horizontal demand at that price.

The second model is the rational expectations equilibrium model. It is based on the principle of an expectations equilibrium in the sense that individuals condition their expectations about the underlying state of nature upon the equilibrium values of the endogenous variables of the system. The equilibria themselves must be consistent with this type of "adaptive" behavior. A variety of models exist depending upon the information conveyed to agents by the equilibrium values, the inference process of agents, etc. but, for the parameter values and settings we chose for the experimental markets, the predictions of various rational expectations models seem to be substantially in agreement.

The prior information equilibrium prices given states X, Y, and Z are not the same and the prior information equilibrium net trade matrices are not the same in each state. Furthermore, prices and net trades are not the same in states X, Y, and Z given that fully informed

equilibria are attained in the state. Therefore, individuals who have no external information about the state of nature but who observe all transactions should, according to the rational expectations equilibrium models, infer the states of nature and adjust their behavior accordingly. The resulting predictions are as follows in Figure 5.

Notice that the critical differences between the price predictions of the two models occurs when the expected value of the certificate based upon the prior information and dividends of the uninformed individuals lies above the rational expectations equilibrium price. The rational expectations equilibrium models predict that such individuals will revise their expectations downward based on market generated information and allow the price to fall.

The pattern of holdings predicted by the two models almost always differs. The rational expectations model predicts that the uninformed individuals will behave the same as the insiders since market price here is "fully revealing." Thus, the prior information equilibrium predicts that only the insiders of a given type can hold while the rational expectations model predicts that all members of this type can hold.

For convenience of exposition the competing predictions can be summarized by the following two hypotheses.

Hypothesis 1: Prices converge to the prior information equilibrium values given in Figure 4.

Alternate Hypothesis 1: Prices converge to the rational expectations equilibrium values given in Figure 5.

FIGURE 4

PRIOR INFORMATION EQUILIBRIUM MODEL PREDICTIONS

Market	Price				Type of Agent Holding Certificates in Equilibrium			
	Information of Insiders				Information of Insiders			
	None	X	Y	Z	None	X	Y	Z
2	266	266*	350		I and II	I and II uninformed*	I insiders*	
3	220	400	220*		I	I insiders*	I uninformed*	
4	210	375	210*		I	I insiders*	I uninformed*	
5	212	212*	245	320	I	I uninformed*	II insiders*	I insiders

*The prediction here differs from the rational expectation model.

FIGURE 5

RATIONAL EXPECTATIONS EQUILIBRIUM MODEL PREDICTIONS

Market	Price				Type of Agent Holding Certificates in Equilibrium			
	Information of Insiders				Information of Insiders			
	None	X	Y	Z	None	X	Y	Z
2	266	240*	350		I and II	III*	I*	
3	220	400	175*		I	I*	III*	
4	210	375	175*		I	I*	III*	
5	212	180*	245	320	I	III*	II*	I*

*The prediction here differs from the prior information equilibrium model.

Hypothesis 2: Security holdings converge to the prior information equilibrium values given in Figure 4.

Alternate Hypothesis 2: Security holdings converge to the rational expectations equilibrium values given in Figure 5.

Two additional measures are relevant for separating the prior information and rational expectation ideas. The first is profit. The second is market efficiency.

If the market data are completely revealing of the state, then insider information is of no value. Thus, under the rational expectations hypothesis insiders should do no better than uninformed individuals. In some respects this may be a better indicator of market generated information than the final holdings. Risk averse, uninformed individuals may reap the benefits of almost full information by selling to informed individuals at near equilibrium prices and avoid the risk of holding in the absence of certainty. The holdings data could then be used to reject the rational expectations model even though the uninformed acted with very little uncertainty.

Hypothesis 3: Profits of insiders are greater than the profits of the uninformed agents as implied by the prior information equilibrium prices and allocations given in Figure 4.

Alternate Hypothesis 3: Profits of insiders and the uninformed agents converge to equality as implied by the rational expectations equilibrium prices and allocations given in Figure 5.

Market efficiency is ex ante consumer plus producer surplus. For these markets it can be measured by the total profit of agents. A market operating at 100 percent efficiency will maximize the total dollar returns of agents given the information that exists in the market. Ordinarily the measure (Plott and Smith 1978) is efficiency in absolute terms.

The concept of efficiency when applied to markets with insiders is complicated by two considerations. First, uncertainty exists so the measure must reflect the information which exists in the market. The following measure seems to be the appropriate generalization to the case of uncertainty:

$$\text{PS efficiency} = \frac{\begin{array}{c}\text{Total expected returns to allocation, A,}\\ \text{conditioned on available information}\\ \text{in the market.}\end{array}}{\begin{array}{c}\text{Total expected return of rational}\\ \text{expectations allocation, } \hat{A}\text{, conditioned}\\ \text{on information in the market.}\end{array}} \equiv \frac{ER(A|I)}{ER(\hat{A}|I)} .$$

The idea is that the rational expectations allocation yields the maximum which can be reasonably expected. PS efficiency is simply the expected value of the actual allocation taken as a percentage of that maximum.

The second problem involves initial endowments. The markets we studied are reasonably efficient even if no trade takes place. In order to emphasize this fact we have constructed a measure which takes as "zero" the no trading case. Let $\bar{X}$ be the no trade allocation of initial endowments.

$$\text{Trading efficiency} = TE = \frac{ER(A|I) \text{ minus (expected returns of } \overline{X} \text{ conditioned upon information in the market)}}{ER(\hat{A}|I) \text{ minus (expected returns of } \overline{X} \text{ conditioned upon information in the market)}}.$$

Since different models sometimes predict different allocations, the efficiency measure of the actual allocation when compared with the efficiency predicted can be used as a measure of the relative accuracy of competing models. Of course this measure defines the efficiency of the rational expectations equilibrium allocation to be 100 percent. The efficiency of the prior information equilibrium allocation differs from this only when certain events occur. Figure 6 lists the efficiency of the prior information equilibrium allocation (both PS and TE) for all information conditions of all experiments.

Hypothesis 4: Plott-Smith (PS) and Trading (TE) measures of efficiency converge to the values given in Figure 6 which are implied by the prior information equilibrium.

Alternate Hypothesis 4: PS and TE measures of efficiency converge to 100 percent in all cases as implied by the rational expectations equilibrium.

Three ideas must be listed for completeness. First, the Keynes model (1936) suggests that speculation can cause the price to be unrelated to underlying returns and information. Some may even claim that price can be anything. Due to a problem recognized by Beja (1976) and Milgrom (1979) certain formalizations of the fully revealing or efficient market hypothesis can lead to such a conclusion.

If price is a sufficient statistic for the state, individuals can ignore all their private information thereby yielding all prices in the range of the equilibrium price correspondence as equilibria for all states of nature. On this interpretation prices should be at one of the rational expectations equilibrium prices but beyond that there need be no relationship between the actual state, the underlying returns and information, and the price. This implies rejection of all four pairs of hypotheses discussed above.

The second is the strong version of the efficient markets hypothesis which suggests that prices adjust instantaneously to all available information. Replication of time periods is unnecessary to establish equilibria.

The third is the crystal ball hypothesis which maintains that market adjustments reflect information beyond that held by agents. It is tempting to assert that "agents will somehow know" and then apply a model as if they do. This hypothesis would have markets adjusting perfectly even when no agent has information beyond prior information.

IV. RESULTS

The time series of prices for all periods of all markets are shown on Figure 7 through 11. Price predictions of the prior information model when different from those of the rational expectations equilibrium model are shown by the horizontal dotted line. Predictions of the rational expectations equilibrium model are shown by the horizontal solid line.

Hypotheses about prices, 1 and Alternate 1, are tested in two

FIGURE 6

PRIOR INFORMATION EQUILIBRIUM ALLOCATION EFFICIENCIES

Market	Measure Type	Information State			
		No Information	X	Y	Z
1	PS	100	50	100	
	TE	100	-125	100	
2	PS	100	42	100	
	TE	100	-133	100	
3	PS	100	100	57	
	TE	100	100	-125	
4	PS	100	100	57	
	TE	100	100	-125	
5	PS	100	67	100	100
	TE	100	-112	100	100

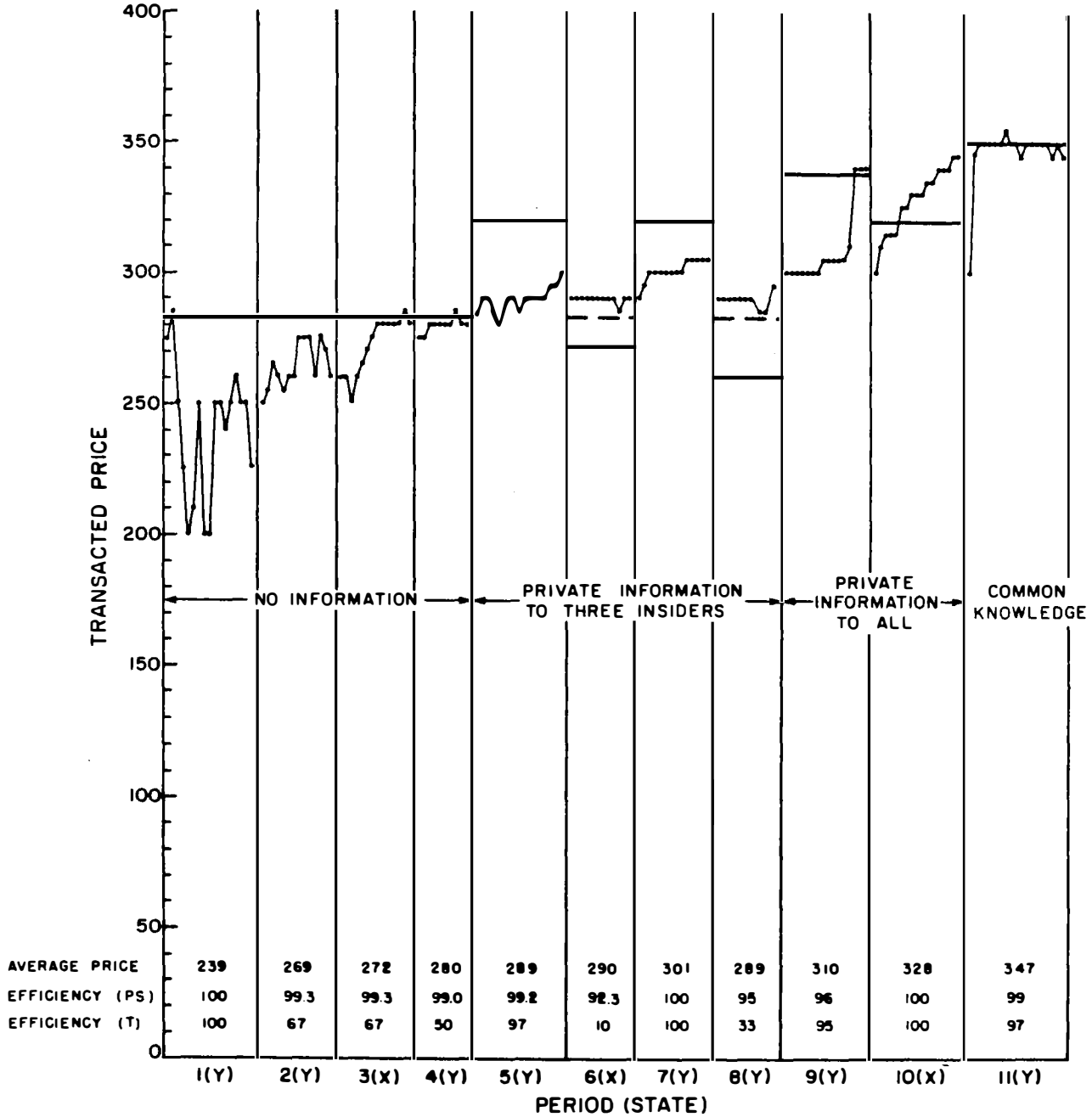


FIGURE 7. MARKET I

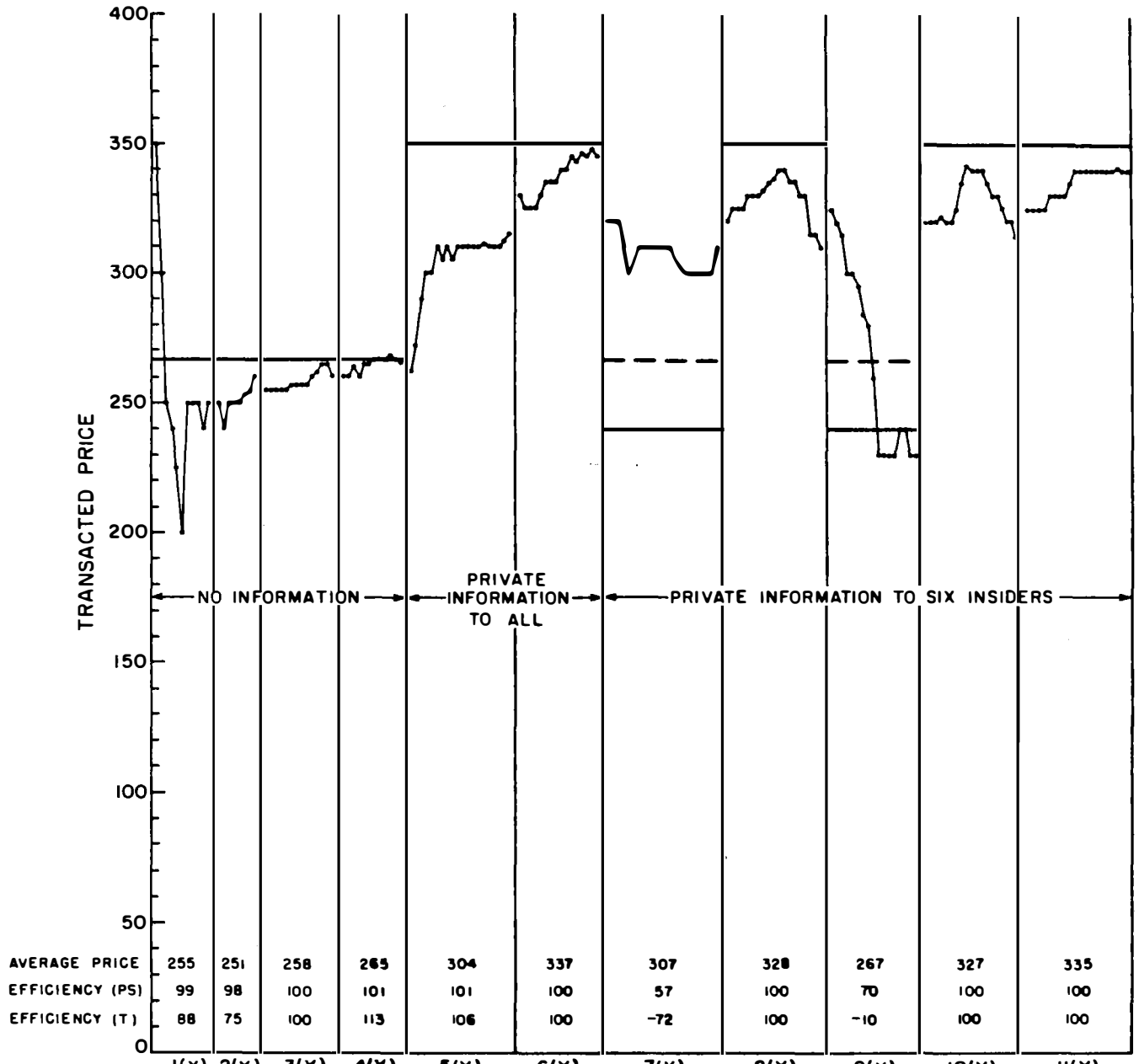


FIGURE 8. MARKET 2

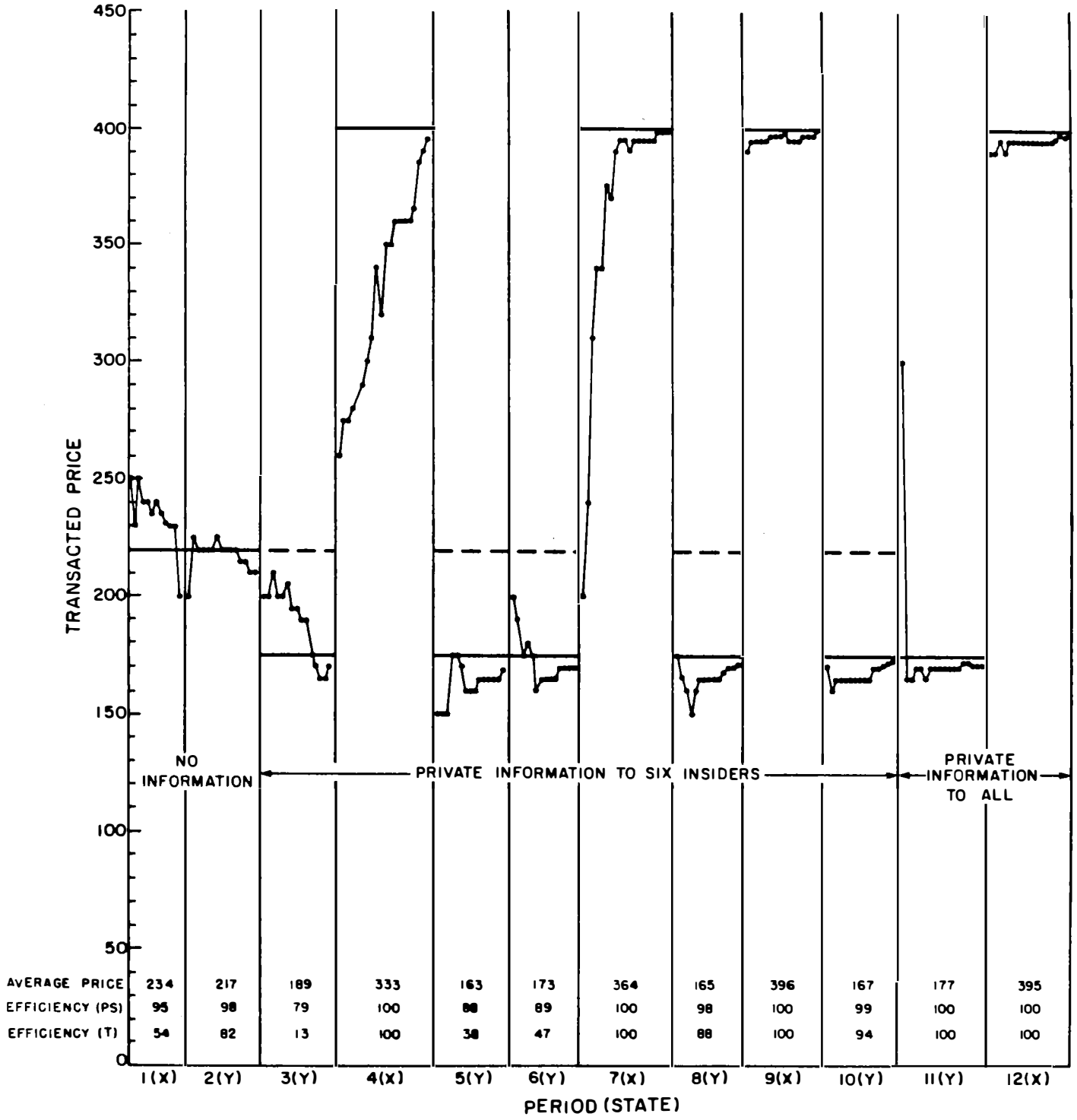


FIGURE 9. MARKET 3

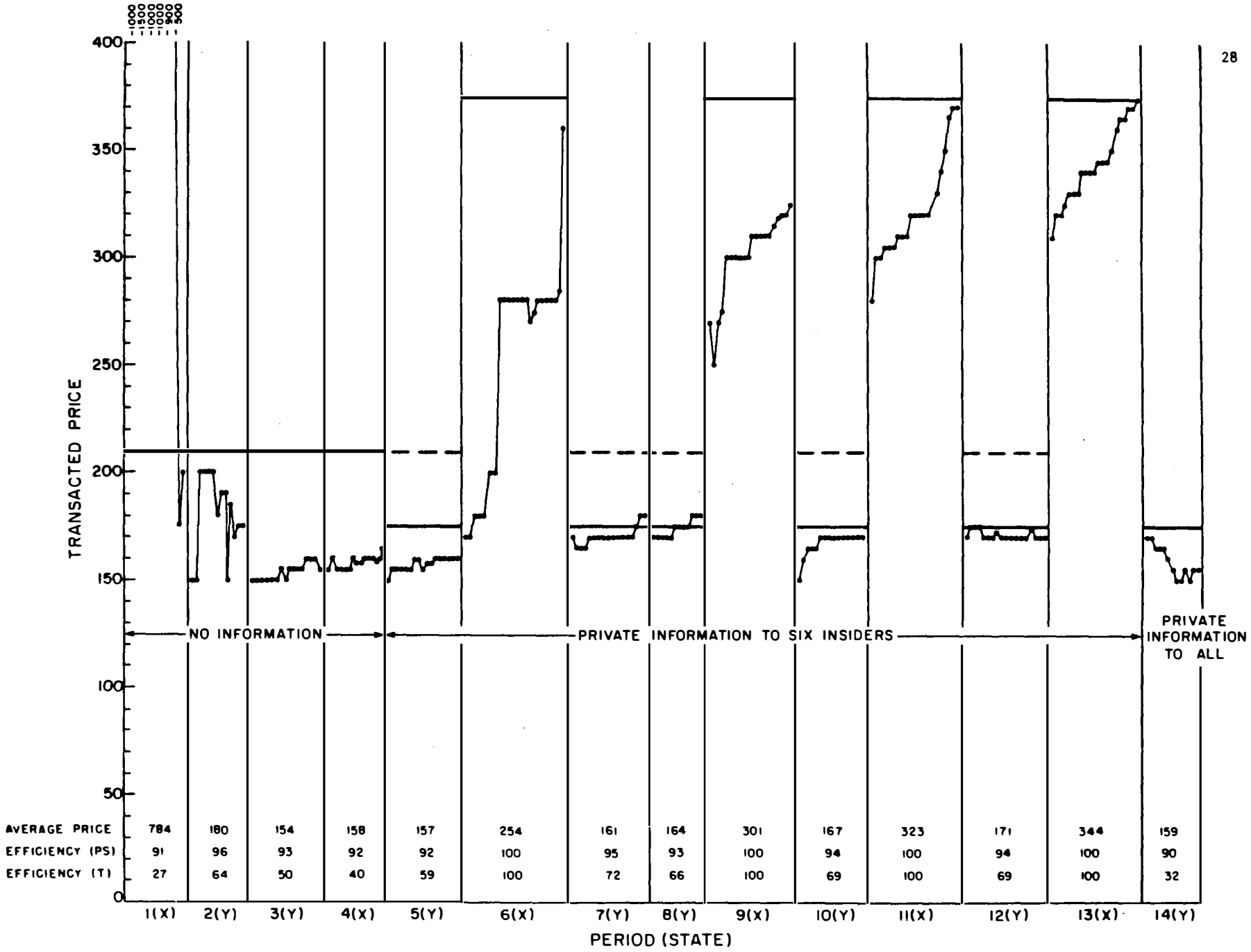


FIGURE 10. MARKET 4

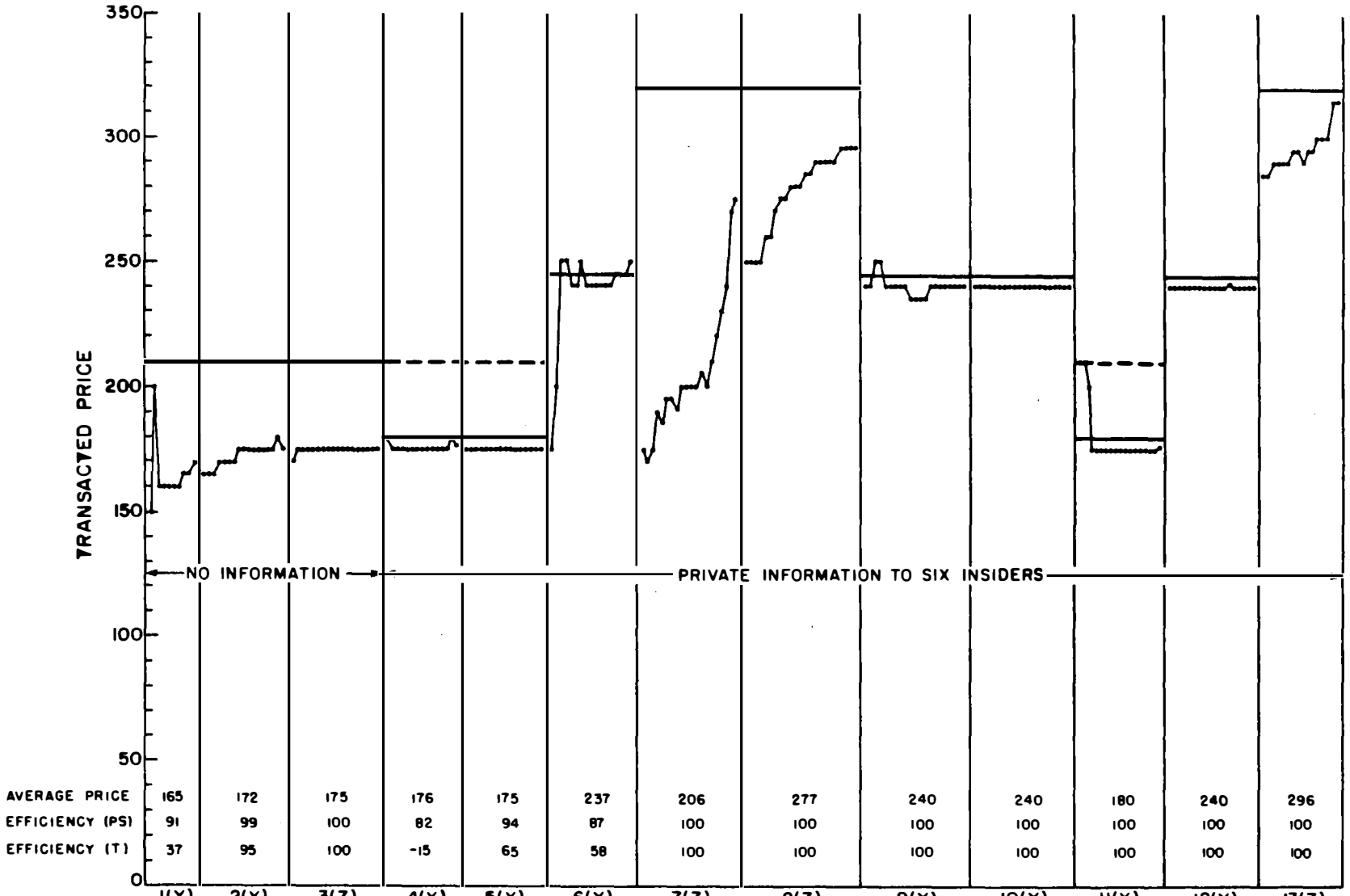


FIGURE II. MARKET 5

steps, first against each other and then the winner against the random price behavior. Hypothesis 1 as well as the random behavior hypothesis is rejected in favor of Alternate Hypothesis 1, that prices converge to the rational expectations predictions.

In Step 1, across all periods of all markets, the price predictions of the competing models differed seventeen times.[3] Figure 12 summarizes three statistics for these seventeen periods. In all but four periods average price is closer to the rational expectations equilibrium than to the prior information equilibrium. Similarly in thirteen of the seventeen periods the average absolute and squared deviations from the rational expectations equilibrium are smaller than the corresponding deviations from the prior information equilibrium. Further, the relative advantage of the RE over the PI model increases upon replication.

The three exceptions are of interest. Two exceptions are periods 6 and 8 of market 1, the pilot. These observations lead us to suspect that the prior expectations model was the better model. The remaining experimental design was developed to demonstrate this possibility within a framework of reduced states (from the agents point of view) which would give markets adequate time to adjust. The next exception is period 7 of market 2. This is the first time this particular state occurred in the market. The next time it occurs (period 9) prices start high and then fall immediately to near the rational expectations price although viewing average price of period 9 one might include it as an exception. Thus, the few cases where the prior expectations model does better than the rational expectations occur in the early stages of

experience acquisition. With replication the advantages of the prior expectations model are not sustained.

Market 5 was designed as a check on the robustness of the rational expectations equilibrium model. Because the three-state situation is inherently more complicated, new theories can be developed to compete with the theory of fully revealing prices. In particular, we thought the market might reveal only part of the available information. That is, it may reveal that nature has not chosen some state as opposed to revealing exactly which state was chosen. In the two-state world, revelation of one state which is not, is equivalent to complete state revelation. The three-state world is different. The maximum expected values of uninformed agents by type and by partial information revealed is calculated in Figure 13. As is shown on the price time series, prices never approach these values in periods in which they might be sensibly predicted. The rational expectations model applies to the three-state environment as readily as to the two-state environment.

In the second step, Alternate Hypothesis 1 was compared to the random price behavior hypothesis. Out of 398 nonzero price changes in the five markets, 284 price changes were in the direction of rational expectations equilibrium price. Since under random behavior only one half of these changes would be expected to move the price in the direction of RE price, the probability of the observed behavior being generated by random chance is practically zero (8.5 standard deviations away from the mean). Similar statistics are obtained by testing for convergence of mean squared error and mean absolute deviation from rational expectations price towards zero upon replication.

FIGURE 12

RATIOS OF THREE MEASURES OF DEVIATION FROM THE PI AND RE EQUILIBRIUM PRICES

DURING PERIODS WHEN THE TWO ARE DIFFERENT

Statistic	Market (Period)																
	1		2		3					4					5		
	(6)	(8)	(7)	(9)	(3)	(5)	(6)	(8)	(10)	(5)	(7)	(8)	(10)	(12)	(4)	(5)	(11)
1. Absolute Difference between Average and Equilibrium Price[1]	0.38	0.22	0.60	0.01	2.28	4.72	22.4	5.64	6.70	2.98	3.43	4.24	5.27	10.21	8.56	7.5	107.3
2. Root Mean Squared Deviation from Equilibrium Price[2]	0.36	0.24	0.61	0.80	1.72	4.00	4.51	4.88	6.1	2.95	3.30	3.98	4.39	9.09	7.94	7.44	2.87
3. Mean Absolute Deviation from Equilibrium Price[3]	0.36	0.23	0.60	0.98	1.78	4.74	5.52	5.61	6.67	2.99	3.43	4.28	5.28	10.27	8.57	7.55	3.75

1. $|\overline{P} - P_{Prior}|/|\overline{P} - P_{RE}|$; $\overline{P}$ = average price.

2. $\sqrt{\sum_i (P_i - P_{Prior})^2 / \sum_i (P_i - P_{RE})^2}$

3. $(\sum|P_i - P_{Prior}|)/(\sum|P_i - P_{RE}|)$

FIGURE 13

CONDITIONAL EXPECTED VALUES

INFORMATION	MAXIMUM EXPECTED VALUES	AGENT
The state is not Z	192	II uninformed
The state is not Y	227	I uninformed
The state is not X	262	I uninformed

Hypothesis 2 can be rejected in favor of its alternative. The rational expectations equilibrium model is clearly superior to the prior information model. The error rate of both models is summarized in Figure 14. Each model predicts the type of agents who will hold the certificates. The figure lists the number of certificates in the wrong hands from the point of view of each model. The models made different predictions in thirty-six periods including market 1. In twenty-nine of these thirty-six periods the rational expectations model involved fewer errors and in a substantial number of these (eighteen of thirty-six) the rational expectations model made no errors at all. In seventeen periods the predictions were disjoint and in thirteen of the seventeen the error rate for the rational expectations model was lower and the four exceptions were all during "adjustment" periods.

An examination of the trading activities of the uninformed agents in periods when others were informed is particularly useful. Negative numbers in Figure 15 indicate the trading activity on the part of the uninformed agents which is consistent with the prior information model and inconsistent with the rational expectations model. Similarly, positive numbers record the trading activity of the uninformed which is consistent with the RE and inconsistent with the PI model. When the two models make contradictory predictions about their trading activity, behavior of the uninformed tends to conform to the PI model in early periods but upon replication, as the experience is gained, the RE model dominates the PI. Note that the behavior of uninformed individuals in contradiction to the PI model implies that these agents

FIGURE 14

NUMBER OF CERTIFICATES IN WRONG HANDS

RATIONAL EXPECTATIONS VS. PRIOR INFORMATION HYPOTHESIS

Market	Total No. Certificates		Period 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	18	Realized State	Y	Y	X	Y	Y	X	Y	Y	Y	X	Y			
		Rational Expectations	0	2	2	3	1	12	0	8	0	2	1			
		Prior Expectations					8	4	7	4						
2	24	Realized State	X	X	Y	Y	Y	Y	X	Y	X	Y	Y			
		Rational Expectations	1	2	0	-1	0	0	22	0	12	0	0			
		Prior Expectations							4	5	23	5	7			
3	24	Realized State	X	Y	Y	X	Y	Y	X	Y	X	Y	Y	X		
		Rational Expectations	10	11	18	0	10	9	0	2	0	2	0	0		
		Prior Expectations			15	8	19	19	11	24	6	24				
4	24	Realized State	X	Y	Y	X	Y	X	Y	Y	X	Y	X	Y	X	Y
		Rational Expectations	13	16	19	19	7	0	3	5	0	4	0	4	0	17
		Prior Expectations					21	2	21	21	2	21	0	21	2	
5	24	Realized State	Z	X	Z	X	X	Y	Z	Z	Y	Y	X	Y	Z	
		Rational Expectations	11	1	0	13	4	10	0	0	0	0	0	0	0	
		Prior Expectations				11	20	13	5	0	7	9	24	11	14	

FIGURE 15

CONTRAST BETWEEN THE TRADING BEHAVIOR OF THE UNINFORMED PREDICTED BY RE AND PI MODELS

Row 1. Certificates purchased per uninformed agent for which the models have opposite predictions: the PI model predicts sales while the RE model predicts purchases.

Row 2. Certificates sold per uninformed agent for which the models have opposite predictions: the PI model predicts purchases while the RE model predicts sales.

Market Experiment		Period 3	4	5	6	7	8	9	10	11	12	13	14
	Realized State			Y	X	Y	Y						
1	Row 1			0.5		0.5							
	Row 2				0		-0.5						
	Realized State					X	Y	X	Y	Y			
2	Row 1					-1		-1.5					
	Row 2					-2.5	2	-0.75	2	2			
	Realized State	Y	X	Y	Y	X	Y	X	Y				
3	Row 1	-1.5	2	0.5	1.5	3.5	5	1	4.5				
	Row 2	-2.5		-0.5	-0.25		2		2				
	Realized State			Y	X	Y	Y	X	Y	X	Y	X	
4	Row 1			-1.5	-1	-1.5	0	-1	-0.5	-2	1	-1	
	Row 2			0.5		0.5	0.5		0.5		0.5		
	Realized State		X	X	Y	Z	Z	Y	Y	X	Y	Z	
5	Row 1		-2	-0.5	-0.5	0.5	-2	1.5	2.5	2	3.5	5	
	Row 2		-4	0	-3			2	2	2	2		

were so sure of having learned the state from the endogenous variables that they chose to hold these positions even though they could have avoided all uncertainty by trading, usually very close to the rational expectations equilibrium price.

The profits of insiders relative to the uninformed agents, summarized in Figure 16 reject Hypothesis 3 in favor of its alternative. Shown there for each period of each market is the ratio of average profit per insider to the average profit per uninformed agent earned during the period. In all cases the ratios approach one as the experience in the market accumulates. The early "jumps" reflect first experiences with a new state. During initial periods insiders have the advantage. After replication, however, the advantages of inside information vanish completely.

Both efficiency measures are shown for all periods of all markets in Figures 7 through 11. As can be seen, these are high. The fourth hypothesis is formalized as follows.

Let I be the set of periods for which the prior information equilibrium price is different from the rational expectations equilibrium price which is a necessary and sufficient condition for the prior information equilibrium allocations (A) to be different from the rational expectations equilibrium allocations ($\hat{A}$) across agents classified by dividend distributions. Let $i \in I$, and PS(x) and TE(x) be the Plott-Smith and trading efficiency measures of an allocation x. Let $\hat{x}_i$ be the actually realized allocation in period i. Then Hypothesis 4 asserts that for trading efficiency:

$$\| \sum_{i \in I} TE(\hat{A}_i) - TE(\hat{x}_i) \| < \| \sum_{i \in I} TE(\hat{x}_i) - TE(A_i) \|$$

and similar relationship holds for PS efficiency. Note that $TE(\hat{A}_i)$ is defined to be 100 percent.

The data in Figure 17 reject Hypothesis 4 in favor of its alternative. The mean efficiencies are much closer to the rational expectations prediction (100) than to the prior information prediction of 57 for PS efficiency and -123 for trading efficiency. Chronogically, as the traders gain experience, the efficiency measures move consistently from close to prior information prediction towards the rational expectations predictions. Out of eleven changes in efficiency measures repeated in Figure 17, nine changes are away from prior information towards the rational expectations prediction. The probability of obtaining nine out of eleven changes of the same sign by random chance is only 0.039.

We feel we can safely reject the strong rational expectations model, the Keynes model, and the crystal ball model as general models. Markets take time to adjust to structural changes so the strong rational expectations model can be rejected. After the rational expectations equilibrium is established, prices change instantaneously in response to different realizations of state but a structural change such as a new and unknown state of nature will not be instantaneously adjusted to. In this sense we have replicated a finding in Forsythe, Palfrey, and Plott (1980). The early periods of no information adjust closely to the expected value and come nowhere close to the perfectly informed equilibria so the crystal ball hypothesis is discredited.

Our version of Keynes can be rejected because the rational expectations model does so well. The problem is of course that our model does not fully capture the idea that speculation on speculators can cause

FIGURE 16

NET PROFIT OF INFORMED AGENTS AS A PERCENT OF

NET PROFIT OF UNINFORMED AGENTS*

Market	Realized State	Period 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	X			68			147				-53				
	Y	108	88		110	118		118	91	109		98			
2	X	85	105					6208		267					
	Y			107	115	100	103		107		109	105			
3	X	76			100			103		101			100		
	Y		97	230		129	137		102		93	99			
4	X	111			152		178			142		130		117	
	Y		108	109		128		123	118		119		113		90
5	X		121			147	115					105			
	Y						141			102	101		100		
	Z	69		100				157	135					97	

*There was no difference in information provided to various individuals during periods covered by hatched boxes. Figures are given for control.

FIGURE 17

EFFICIENCY MEASURES FOR PERIODS IN WHICH PRIOR INFORMATION EQUILIBRIUM ALLOCATIONS DIFFER FROM THAT OF THE RATIONAL EXPECTATIONS MODEL

Market	Efficiency Measure*	Under Prior Information Equilibrium Allocations	Under Actual Allocations (listed for each period chronologically)	Under RE Equilibrium Allocations
2 (State X)	PS	42	57, 70	100
	TE	-133	-72, -10	100
3 (State Y)	PS	57	79, 88, 89, 98, 99	100
	TE	-125	13, 38, 47, 88, 94	100
4 (State Y)	PS	57	92, 95, 93, 94, 94	100
	TE	-125	59, 72, 66, 69, 69	100
5 (State X)	PS	67	82, 94, 100	100
	TE	-112	-15, 65, 100	100
Mean Efficiency	PS	57	88.3	100
	TE	-123	45.5	100

*PS = Plott-Smith (1978) efficiency measure.
TE = trading efficiency measure.
See Section III for discussion.

price to wander. If we treat any evidence of (nonrational expectations) equilibrium behavior as support for the Keynes model, then the Keynes model deserves a closer look. During the no-information periods of the first three experiments, prices converged to near the maximum expected value. In market 4 this did not happen. Prices remained well below the maximum expected value for the first four periods while the no-information condition was in effect, and returned to the low levels in period 14 when the no-information condition was imposed again. The same phenomena occurred during the first three periods, the no-information condition of market 5. In both cases prices converge to a rational expectations equilibrium price, but it is the wrong price, given the information. The Beja/Milgrom criticism of rational expectations rests on the possible existence of exactly this type of phenomenon.

We suspect the failure to adjust to the maximum expected value resulted from the fact that no one knew that no one was informed in market 4. This in essence adds two subjective states, giving a total of four (X and no one knows, Y and no one knows, X with insiders, Y with insiders) and thus would increase the number of total replications necessary for the convergence behavior. The large number of holdings on the "wrong" side of the market supports this hypothesis. For the first three periods of market 5 all agents should have known that no one was informed since no clue card was passed out as had been the case in the previous markets in which they had participated, nor was the method of giving clues even explained. We suspect, however, some possible confusion, as

subjects speculated on the possible sources of others' information, thereby increasing the state space. Notice that the holdings were converged to the rational expectations pattern even though price had not adjusted. In summary, we suspect these uninformed periods provide support for a theory of temporary equilibria as opposed to the possible existence of "Keynesian type" phenomena. Given the state of the data and theory, we cannot draw any firm conclusions.

The other period of interest in this regard is period 10 of experiment 1. Notice that price is increasing substantially above the expected value prediction. In all twelve trades above the expected value the buyer was the same agent and he was an insider. This individual was simply overly optimistic given his information. The fact that this unwarranted (in theory and in fact) optimum did not serve as a lure for uninformed individuals does not reflect well on the Keynesian model. This was a good opportunity for a "bubble" but one did not develop.

V. IMPLICATIONS FOR RELATED ISSUES

Rational Expectations Formation

Since no theoretical models predict the path (as opposed to the end point) of the learning process in asset markets, we cannot conduct formal tests of theory. In this section we provide some descriptive material in the hope that generation of such data may help promote development of dynamic models of learning in competitive asset markets.

In our markets, at least two kinds of learning are identifiable. At the beginning of the first period of a market, uninformed agents do not know the state, and no agent knows what the market price would be under any given state. The formal models referenced in earlier sections of the paper are concerned primarily with the learning about the state. Knowledge of the equilibrium price and net trade correspondence, given a common pattern of information in the market, is reflected in agents' decisions. From studying the static models one could easily infer that agents must first learn about the equilibrium price and net trade correspondence (the price given the state) and then learn about the state from market conditions, e.g. price. Applied to the markets studied here this reasoning suggests that an agent must learn first about the structure of the dividends under various states and then learn about the state given the market conditions if (s)he is not an insider.

In the experimental markets the two types of learning do not seem to occur sequentially. Instead they seem to occur simultaneously.

The profit data can be used to make the point. The ratio of profits of buyers to sellers reflects the state of knowledge about the state-price correspondence. Insiders and uninformed agents are represented in equal numbers on both sides of the market (except in market 1 where three out of nine are insiders). Furthermore, initial endowments of sellers should be transferred to buyers at prices approximating the value of the initial endowments of buyers and which afford buyers very little profit on the transaction. Therefore, profits

of buyers and sellers might reasonably be expected to be equal if the equilibrium price correspondence has been revealed and understood. Thus, as the ratio of profits of buyers to sellers goes to one, we can say agents have learned to state equilibrium price correspondence.

Learning about the state, given market conditions, is reflected in the differences between profits of insiders who are perfectly informed about the state (with the exception of market 1 where information is imperfect) and the uninformed agents. If the difference is zero (if the ratio is one), then the informed agents (insiders) and uninformed agents are equally informed.

For each experiment the ratio of buyer and seller profits for each period is shown in Figure 18. The ratio of profits of insiders and uninformed agents is shown in Figure 16. As can be seen, both measures converge to near one as replications occur and all agents become informed about both correspondences. Notice that the convergence occurs simultaneously. Thus, given these measuring devices, we conclude that learning about the price, given the state, and learning about the state, given the market, occur simultaneously and not sequentially as the comparative static models suggest.

Sources of Agent Information

While these markets are simple relative to naturally occurring markets, they are nevertheless complex. The results indicate that agents are receiving accurate information from some source but the exact source could not be determined. Bids, offers, and contracts were all made publicly by voice interaction. All were written on the blackboard.

FIGURE 18

RATIO OF PROFITS OF BUYERS TO PROFITS OF SELLERS

Market	Type of Buyers	Period 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	I					1.58		1.49	1.39	1.41		1.03			
	II														
	III						1.53				5.30				
2	I					1.44	1.12		1.20		1.20	1.14			
	II														
	III							4.66		1.72					
3	I				1.64			1.13		1.03			1.03		
	II														
	III			1.60		1.36	1.29		1.20		1.14	1.09			
4	I						2.12			1.90		1.56		1.28	
	II														
	III					1.31		1.33	1.27		1.22		1.18		1.37
5	I							2.69	1.34					1.25	
	II						1.40			1.08	1.06		1.06		
	III				1.39	1.16						1.06			

The timing of activities occurred in real time and on occasion curses, laughter, or other signs of emotion may have been detectable in spite of efforts to control it.

From a formal point of view much more information was available than equilibrium prices. Thus, more information was available than is called for by the efficient markets hypothesis (Grossman 1978; Jordan 1979). But it was not clear what information was used.

We made two attempts to narrow the possibilities some. After the market, a questionnaire was circulated which attempted to measure the extent to which individuals could identify insiders. Recall the method of distributing inside information did not reveal the identity of insiders. Generally, insiders seemed to be more aware of other insiders than were those who were uninformed. Most uninformed would correctly guess at least one insider if their options were limited to two. We conjecture, however, that knowledge of insiders' identity is not a necessary condition for convergence in these markets.

The second attempt involved an analysis of bids and offers. Notice in markets 3, 4, and 5 that after some replications the opening contract is near the rational expectations equilibrium price. Somehow the insiders are unable to take advantage of their privileged position without revealing the state of nature. Figure 19 suggests that one possible key is the pattern of bids and offers. Competition among insiders occupies much of the opening market activity. In Figure 19 for each market for those periods in which insiders exist is given the proportion of all first market action, an opening bid or offer,

which involved an insider. The proportion of times an insider is involved with the second, third, sixth, and eighteenth market actions are also given. The cumulative proporations are also given.

The relative activity of insiders decreases with time. The proportion of periods in which an insider made the first bid or offer in market 1 was .75, and it was .20, .83, .89, and .80 for markets 2 through 5 respectively. The proportion of the first eighteen bids and offers during all relevant periods of market 1 made by insiders was .39 and for markets 2 through 5 respectively it was .41, .52, .74, and .61. In four of the five markets relative activity of insiders decreases with time. It seems as though competition, evidenced by competing bids and offers among insiders during the opening stages of a period reveals the state to the uninformed.

The exception to the pattern, market 2, is instructive and indicates the limitations of the measure we present. The opening offers in market 2 were made by uninformed individuals. They were also "safe" in the sense that they would have been reasonable sales given that the high price state existed (recall in market 2 agents had experience with the environment under conditions of complete information). Similarly, uninformed buyers can make safe opening bids. Information is revealed when someone (presumably an insider attempting to take advantage of the information) drops (increases) the offer (bid) substantially below (above) the safe levels. Thus, it is not simply bids and offers which convey the information, but certain critical bids and offers seem to convey it. Unfortunately at this time we cannot identify these operationally.

FIGURE 19

RELATIVE ACTIVITY OF INSIDERS IN EARLY STAGES OF MARKETS

Market	Proportion of nth Market Action Involving Insiders					Cumulative Proportion of Market Actions Involving Insiders up to nth Action				
	n = 1	2	3	6	18	1	2	3	6	18
1	0.75	0.00	0.50	0.25	0.00	0.75	0.39	0.42	0.42	0.39
2	0.20	0.40	0.20	0.40	0.00	0.20	0.30	0.27	0.40	0.41
3	0.83	0.67	0.67	0.17	0.50	0.83	0.75	0.72	0.69	0.52
4	0.89	0.89	1.00	0.67	0.78	0.89	0.89	0.93	0.80	0.74
5	0.80	0.50	0.80	0.44	0.60	0.80	0.65	0.70	0.67	0.61

The discussion of bids, offers, trader identification and other endogenous sources of information suggests that the trading institutions themselves may be important in determining the applicability of the rational expectations models. Institutions can dictate the type of information available to participants. For example, a computerized market which masks bids, offers, and trader identity or even volume may not operate as efficiently as one which does not. The closed book of the specialist is certainly an institution worthy of consideration in this regard.

Statistical Analysis of Price Changes

Even though only single-period securities are traded in these markets, their price data do have some properties typical of stock markets. The price series becomes a fair game as rational expectations equilibrium is established. Further, the transaction-to-transaction log price returns have a serial correlation very close to zero and their density function is leptokurtic (fat tailed relative to the normal density function).

The fair game efficient market model implies that it is not possible to devise trading rules based on past prices (weak form efficiency) that will earn abnormally high returns on a consistent basis (Fama 1970). We tested five trading rules: (1) buy and hold, (2) trend filter, (3) 1-franc filter, (4) 5-franc filter, and (5) 25-franc filter.[4] For the single-period security used in these markets, equilibrium return over time is zero. The naive buy and hold strategy yields a median return of 10 francs per period and mean return of 14.9 francs

per period which is significantly positive (see Figure 20). This return is generated during the disequilibrium periods and declines to zero as rational expectations equilibrium is approached. Ordinary least squares regression of Buy and Hold returns (BH_t) earned each period on the absolute difference between equilibrium and average trading price (d_t, a measure of disequilibrium trading) yields the following estimates:

$$BH_t = \underset{(-0.22)}{-1.86} + \underset{(3.12)}{0.609}\, d_t,\ R^2 = 0.14,\ \text{Durbin Watson statistic} = 1.94.$$

T-statistics are given in parentheses.

The results suggest that the profits generated by the buy and hold strategy are largely the product of disequilibrium trading.

Trend and 1- and 5-franc filters perform about as well as the buy and hold strategy; the 25-franc filter performs worse than the buy and hold. As equilibrium is approached, the returns from these filters also approach zero.

Returns from using the perfect advance knowledge of rational expectations equilibrium price[5] are given in the last row of Figure 20. These returns are equal to or greater than the buy and hold strategy and indicate that the knowledge of equilibrium price is useful for trading in this market even though this price is not always attained. In Keynes model this knowledge would not be useful for a single investor.

The first order serial correlation of log price changes ($\log_e P_t/P_{t-1}$) is very close to zero. Serial correlation in data for individual trading periods ranged from -0.65 to 0.60 with a median of

FIGURE 20

PROFIT FROM MECHANICAL TRADING RULES:

TESTS OF FAIR GAME HYPOTHESIS*

	Median	Mean	Standard Deviation	t-statistic of Excess Profit over Buy & Hold
Buy & Hold	10.0	14.9	53.9	
Trend Filter	4.0	16.9	39.5	0.36
1-Franc Filter	3.0	10.5	37.7	-0.75
5-Franc Filter	4.0	11.1	37.4	-0.64
25-Franc Filter	0.0	2.1	33.8	-2.16
Perfect Information about RE Price	10.0	26.1	40.3	2.09

*The date for period 1 of market 4 were excluded in calculating the means.

0.00 and mean of -0.022 (standard deviation 0.30). The magnitude of serial correlation does not seem to be affected by the existence of disequilibrium trades as is indicated by the following regression of estimated serial correlation for each period ($\hat{\rho}_t$) on the absolute deviation of average trading price from the RE equilibrium price d_t:

$$\hat{\rho}_t = \underset{(-0.83)}{-0.0357} + \underset{(0.75)}{0.00038}\, d_t$$

T-statistics are given in parentheses, the coefficient of determination is 0.01 and Durbin-Watson statistic is 1.91.

The distribution of relative price changes in our markets is leptokurtic (fat tailed) compared to the normal distribution. Sample kurtosis (fourth moment around mean divided by squared variance) in all five markets, 13.7, 19.3, 52.9, 56.3, and 30.3 respectively, is much greater than the kurtosis of normal distribution which is 3. Relatively large proportions of observations in the peak of the distribution of price changes derive from periods in which trading is at or close to the equilibrium price while the larger price changes in the tails of the distribution come mostly from trading away from equilibrium price. This observation might lead one to speculate that the leptokurtosis of security price returns is generated by disequilibrium trading and that reduction in disequilibrium trading would tend to bring the distribution closer to the normal. However, preliminary tests on our data do not support such a conclusion. For each market we identified periods when much of the trading was and was not close to equilibrium by visual examination of price series and calculated the kurtosis of

price changes observed in each class of periods. The results are shown on Figure 21. In three of the five markets the kurtosis of price changes observed in "equilibrium trading" periods alone is greater than that for "disequilibrium trading" periods.

CONCLUSIONS

Given time and replications these markets behave substantially as predicted by rational expectations equilibrium models. There seems to be no doubt that variables endogenous to the operation of these markets served to accurately convey the state of nature to otherwise uninformed agents. We can conclude that the rational expectations models must be taken seriously as not universally misleading about the nature of human capabilities and markets. Of course, only additional research will determine to what extent the experiences acquired in these simple markets can be extended to more complicated naturally occurring markets.

The exact variable(s) which serve(s) to inform the uninformed about the underlying state may differ according to the structure of the market institutions. Market institutions differ widely accoring to the nature of the endogenous variables observable by participants. Thus, institutional features might have implications for both the existence of rational expectations equilibria and the speed with which they are attained. In these double oral auctions the key variables are not yet identified, but we suspect a knowledge of unaccepted bids and offers, in addition to price, are of primary importance.

FIGURE 21

KURTOSIS OF RELATIVE PRICE CHANGES

		Disequilibrium Periods	Equilibrium Periods	All Periods
Market 1	Periods	1, 2, 3, 5, 7, 8, 9, 10	4, 6, 11	
	Kurtosis	11.2	22.1	13.7
Market 2	Periods	1, 2, 3, 5, 6, 7, 8, 9, 10	4, 11	
	Kurtosis	15.7	0.72	19.3
Market 3	Periods	1, 3, 4, 5, 6, 7, 8	2, 9, 10, 11, 12	
	Kurtosis	6.0	60.7	52.9
Market 4	Periods	1, 2, 6, 9, 11, 13, 14	3, 4, 5, 7, 8, 10, 12	
	Kurtosis	31.0	15.6	56.3
Market 5	Periods	1, 6, 7, 8	2, 3, 4, 5, 9, 10, 11, 12, 13	
	Kurtosis	9.8	39.1	30.3

APPENDIX A

MARKET PROCEDURES

Market experiments 2-5 were conducted in three major steps:

1. Training with the mechanism to draw the states of nature.
2. Explanation of procedures and rules of the market.
3. Conduct of markets for several periods.

Market 1 included an additional step:

4. Training with the uncertain clues about the state of the nature.

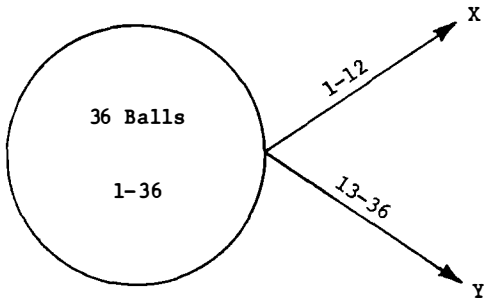
Numbered file folders containing the instructions and record sheets were placed in widely separated seats in the classroom and the subjects were invited into the room and asked to take any seat with a file folder on it and to remember the number on their folder as their identification number. The experimenter led them through the file to identify various items in it.

Step 1. Training with mechanism to draw the states of nature

The subjects were asked to read the first instruction sheet in the folder (Appendix A.1) as the experimenter read these instructions aloud. On the table between the subjects and the experimenter was kept a six inch bingo cage with appropriate number of numbered balls. On the blackboard behind the experimenter Figure A.1 had been drawn for experiment 1 (numbers were changed appropriately for other experiments).

FIGURE A.1

RANDOM DRAWING OF STATE OF THE NATURE



After reading out the instructions, the experimenter pointed out the figure on the blackboard and explained that if the number on the ball drawn from the bingo cage is 12 or less, state of the nature X will be said to have been drawn; otherwise it will be Y. The experimenter rotated the bingo cage and drew a ball as all the subjects watched, read out the number on the ball, say 19, and explained that state Y will be said to have been drawn. This procedure was repeated three times. While the subjects could see the rotation of the bingo cage and the tumbling balls inside it, the numbers on the balls were too small for them to read. After the next draw had been made, the subjects were asked to turn the page of the instructions and predict this draw by circling either X or Y. After everybody had recorded the prediction (verified by a research assistant) the experimenter revealed the number on the ball drawn and the resultant state of the nature. The subjects recorded the outcome and their winnings/losses on their respective sheets. This procedure was repeated from ten to twenty times until most, though not all, subjects predicted the state with the highest relative frequency based on the bingo cage numbers. A research assistant walked around the room to glance at the predictions without talking to any subjects. No mention was made of probabilities.

Step 2. Explanation of Procedures and Rules of the Market

The subjects were asked to read the second set of instructions (Appendix A.2) in the file folder as the experimenter read these instructions aloud. Information and Record Sheet attached to the

Instructions was also drawn on the blackboard. While reading out the trading and recording rules, the experimenter pointed out various columns and rows of the Information and Record Sheet where each transaction must be entered.

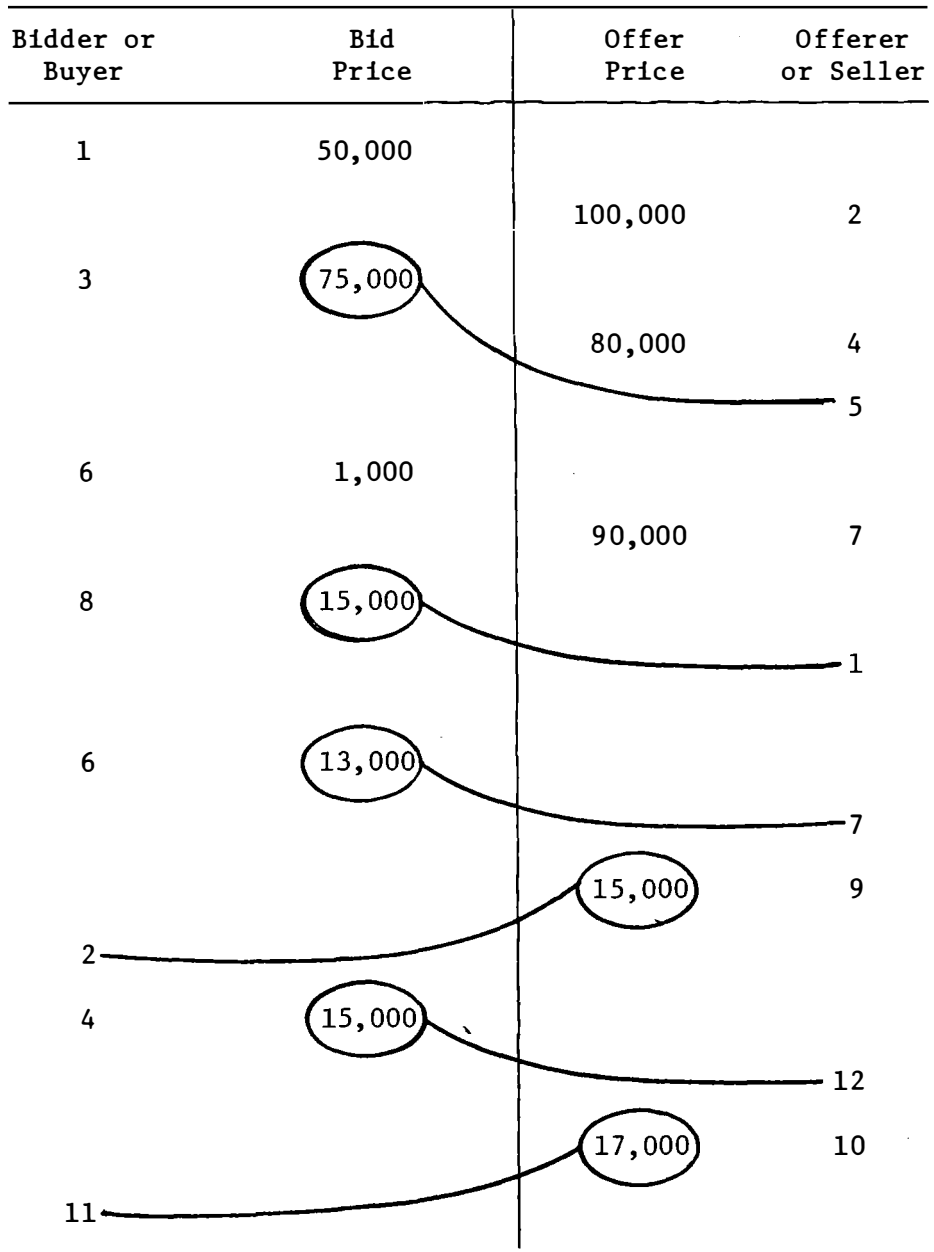
The subjects were asked to open the Zero-Period Information and Record Sheet in which initial endowment of one certificate and one million francs and X and Y dividends of 10,000 and 30,000 francs had been filled in. The experimenter announced hypothetical bids, offers, and transactions from a sheet prepared in advance and asked the involved subjects to record the transaction in their Zero Period Information and Record Sheet as the experimenter recorded these transactions on the blackboard in the format shown in Figure A.2. As each transaction was announced and recorded by the subjects involved in that transaction, the research assistant scrutinized the record sheets and corrected them as necessary. After all zero period transactions were complete, the subjects were asked to calculate their net profit and the experimenter checked their profit calculations against the correct profit number from the prepared sheet. The subjects were told that it is important that all their records be accurate.

Step 3. Conduct of Markets

At the beginning of each period the experimenter announced that he is drawing the state for the period, rotated the bingo cage in full view of all subjects and drew a ball. In markets 1 and 2 (periods 1-4) and market 5 (periods 1-3) the floor was immediately

FIGURE A.2

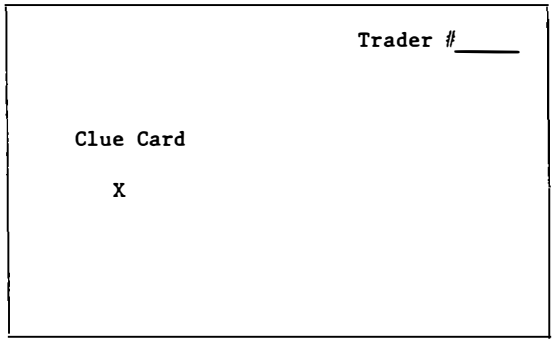
ZERO PERIOD TRADING: HYPOTHETICAL TRANSACTIONS

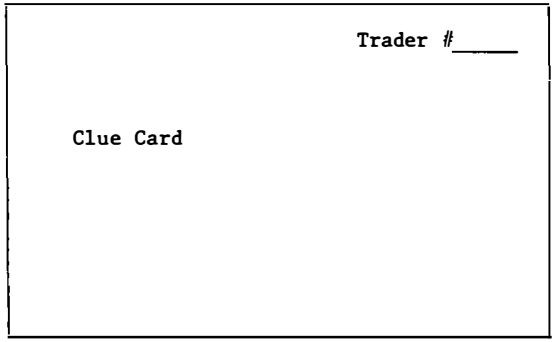


opened for trading. In market 1, period 11 the outcome of the bingo cage was publicly announced and the market was opened for trading. In all other periods of all markets the experimenter looked at the ball drawn and selected a set of prepared 3 by 5 clue cards. The set contained one numbered card for each subject with the information about the state drawn if that subject was to be informed that period and blank otherwise (see Figure A.3). A research assistant showed each subject's clue card to him/her and collected the cards before the trading opened. The trading rules are given on pages 4-5 of Appendix A.2.

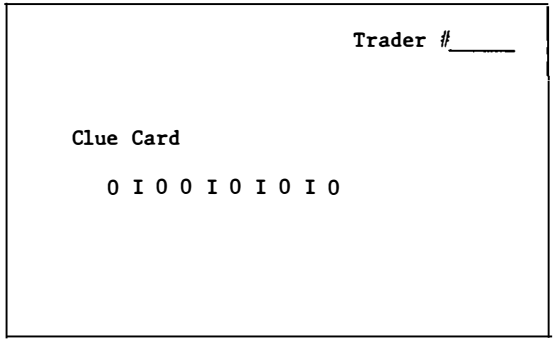
As each bid/offer was made, the experimenter recorded it on the blackboard in the format of Figure A.2. A research assistant kept an independent log on paper. When a subject accepted an outstanding bid or offer, the acceptance was recorded and circled. The research assistant kept the time and announced when two minutes and when thirty seconds of the allotted seven minutes remained in the trading period. At the end of the period, the experimenter announced the state of the nature, recorded it on the board and read out the completed transactions from the blackboard for each subject to recheck and correct, if necessary, their own trading record. The research assistant also checked his record against the blackboard. The subjects calculated their net profit for the period and transferred it to the profit sheet. When all subjects had completed their accounting, the experimenter announced that we were ready for the next period. The trading record and the realized states of four to five periods remained on the blackboard at any one time. In market 5, the research assistant's

FIGURE A.3
EXAMPLES OF CLUE CARDS





For market 1 only



record of trading was photocopied and distributed to each subject at the end of the period.

Step 4. Training with Uncertain Clues about the State of the Nature (Market 1 only)

After following the above mentioned three-step procedure in the first four (no-information) periods in market 1, a fourth step was used to familiarize the subjects with the sample evidence on the state of the nature. The experimenter read out the instructions (Appendix A.3). In addition to the bingo cage used to draw the state of the nature (cage Z) two other cages marked X and Y were kept on the table. "I" balls were white and the "O" balls were colored red so all subjects could clearly see the number of balls of each color in each cage. Figure A.4 was drawn on the blackboard to indicate the relative frequencies of "I" and "O" balls from each cage. A ball was drawn from cage Z, was identified as to state X or Y, and the experimenter drew ten balls with replacement from the appropriate clue cage. As each clue was drawn, it was recorded on the blackboard. This procedure was repeated four times to ensure that the subjects understood how the clues they will later see are drawn.

The subjects were told that the clues listed on the sheet attached to the instructions were drawn using this procedure. The clues were drawn in advance of the experiment to save time. They were asked to make their prediction of the state of the nature that generated each clue and were informed of the actual state in sequence. After twenty-two prediction exercises, we returned to step 3 and started

period 5 of market 1 distributing clue cards of the type shown at the bottom of Figure A.3.

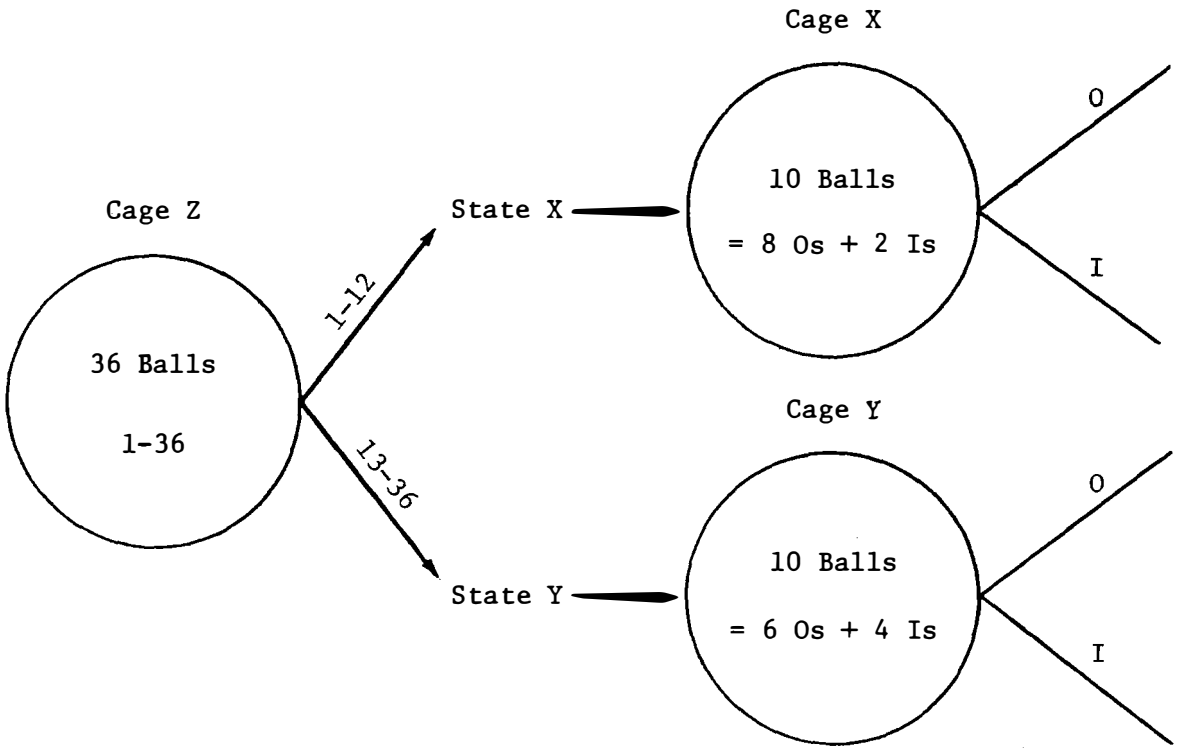
At the end of the last period of each market experiment, the subjects were asked to add their net profits on the Profit Sheet and to include the profits made from the predictions made in step 1 and 4 (if applicable). They were asked to write down their name, social security number and the mailing address at the bottom of the Profit Sheet. If they wanted to participate in further experiments of this type, they were asked to add their phone number. With only a few exceptions, most subjects indicated their willingness, even eagerness, to participate in further experiments. Each subject placed all papers in the file folder and walked to the table where the experimenter paid him/her the net profit indicated on the profit sheet in cash.

In markets 3, 4, and 5 the subjects were given a questionnaire to fill out at the end of the last period (see Appendix A.4) and were paid $1 each for filling it out.

Subjects who participated in markets 1, 2 and 4 were inexperienced in that they had not participated in such an experiment before. Subjects for markets 3 and 5 were experienced since they were drawn from the pool of subjects who had participated in the earlier markets experiments.

FIGURE A.4

UNCERTAIN SAMPLE INFORMATION ON STATE OF THE NATURE



APPENDIX A.1*

INSTRUCTIONS

Each year we draw a ball from a bingo cage containing thirty six balls numbered one through thirty six. If the ball drawn is numbered one through twelve, outcome of the draw is called X; if a ball numbered thirteen through thirty six is drawn, the outcome is called Y.

You have to predict the outcome of each draw before it is announced. If your prediction is correct you win $0.25; if wrong, you lose $0.10. Before the first draw is made, record your prediction by circling either X or Y in the first row of the enclosed sheet. After you have encircled one letter the outcome will be announced and you should record the announced outcome in the blank space on the same row of the table. If your prediction is correct, circle the amount shown in the win column, otherwise circle the amount shown in the lose column.

Once you have recorded your prediction you must not make a change; any erasure will invalidate your prediction. At the end, add up your total winnings and losses and record the difference (net winnings or losses) at the bottom right corner of the sheet.

*The numbers in paragraph 1 were altered appropriately for each experiment. See Figure 2 for parameters.

Subject No._____

Number	Circle One Decision		Outcome X or Y	Circle One Win ($)	Lose ($)
1.	X	Y	_____	0.25	-0.10
2.	X	Y	_____	0.25	-0.10
3.	X	Y	_____	0.25	-0.10
4.	X	Y	_____	0.25	-0.10
5.	X	Y	_____	0.25	-0.10
6.	X	Y	_____	0.25	-0.10
7.	X	Y	_____	0.25	-0.10
8.	X	Y	_____	0.25	-0.10
9.	X	Y	_____	0.25	-0.10
10.	X	Y	_____	0.25	-0.10
11.	X	Y	_____	0.25	-0.10
12.	X	Y	_____	0.25	-0.10
13.	X	Y	_____	0.25	-0.10
14.	X	Y	_____	0.25	-0.10
15.	X	Y	_____	0.25	-0.10
16.	X	Y	_____	0.25	-0.10
17.	X	Y	_____	0.25	-0.10
18.	X	Y	_____	0.25	-0.10
19.	X	Y	_____	0.25	-0.10
20.	X	Y	_____	0.25	-0.10

Total winning _____

Total losses _____

Net winnings/losses _____

APPENDIX A.2

(See page 72 for changes in instructions across experiments.)

INSTRUCTIONS

General

This is an experiment in the economics of market decision-making. Various research foundations have provided funds for this research. The instructions are simple, and if you follow them carefully and make good decisions, you might earn a considerable amount of money which will be paid to you in cash.

In this experiment we are going to simulate a market in which you will buy and sell certificates in a sequence of market years. Attached to the instructions you will find a sheet, labeled information and record sheet, which helps determine the value to you of any decisions you might make. You are not to reveal this information to anyone. It is your own private information.

The type of currency used in this market is francs. All trading and earnings will be in terms of francs. Each franc is worth 0.003 dollars to you. Do not reveal this number to anyone. At the end of the experiment your francs will be converted to dollars at this rate, and you will be paid in dollars. Notice that the more francs you earn, the more dollars you earn.

Specific Instructions

Your profits come from two sources -- from collecting

certificate earnings on all certificates you hold at the end of the year and from buying and selling certificates. During each market year you are free to purchase or sell as many certificates as you wish, provided you follow the rules below. For each certificate you hold at the end of the year you will be given one of the two numbers of francs listed on row 19 of your information and record sheet. Note that earnings may be different for different investors.[1] The method by which one of the two numbers is selected each year is explained later in these instructions. Compute your total certificate earnings for a period by multiplying the earnings per certificate by the number of certificates held. That is

(number of certificates held) x (earnings per certificate) = total certificate earnings.

Suppose for example that you hold five certificates at the end of year 1. If for that period your earnings are one hundred francs per certificate (that is, the number selected from row 19 is 100) then your total certificate earnings in the year would be 5 x 100 = 500 francs. This number should be recorded on row 19 at the end of the year.

Sales from your certificate holdings increase your francs on hand by the amount of the sale price. Similarly, purchases reduce your francs on hand by the amount of the purchase price. Thus you can gain or lose money on the purchase and resale of certificates. At the end of each year all your holdings are automatically sold to the experimenter at a price of 0.

At the beginning of each year you are provided with an initial holding of certificates. This is recorded on row 0 of the year's information and record sheet. You may sell these if you wish or you may hold them. If you hold a certificate, then you receive "earnings per certificate" at the end of the year. Notice therefore that for each certificate you hold initially you can earn during the year at least the amount shown as "earnings per certificate." You earn this amount if you do not sell that certificate during the year.

In addition, at the beginning of each year you are provided with an initial amount of francs on hand. This is also recorded on row 0 of each year's information and record sheet. You may keep this if you wish or you may use it to purchase certificates.

Thus at the beginning of each year you are endowed with holdings of certificates and francs on hand. You are free to buy and sell certificates as you wish according to the rules below. Your francs on hand at the end of a year are determined by your initial amount of francs on hand, earnings on certificate holdings at the end of the year and by gains and losses from purchases and sales of certificates. All francs on hand at the end of a year in excess of 10,000 francs are yours to keep. These are your profits for the year.

Information about Dividends

Whether the dividend you receive from the certificates you

hold is the X-dividend shown on row 19 or the Y-dividend on row 19 is determined by the experimenter at the beginning of the year by drawing a ball from a bingo cage containing forty balls numbered one through forty. If the ball drawn is numbered one through sixteen, X-dividend is paid: if the ball drawn is numbered seventeen through forty, Y-dividend is paid.[2]

At the beginning of each year, before trading starts, each investor will receive a clue card which will carry one of the following three:

(i) X

(ii) Y

(III) a blank.

If your clue card carries an X, the dividend paid at the end of that year will be the X-dividend; if your clue card carries a Y, Y-dividend will be paid. A blank card tells you nothing about whether the X or the Y dividend will be paid.[3]

Trading and Recording Rules

(1) All transactions are for one certificate at a time. After each of your sales or purchases you must record the TRANSACTION PRICE in the appropriate column depending on the nature of the transaction. The first transaction is recorded on row (1) and succeeding transactions are recorded on subsequent rows.

(2) After each transaction you must calculate and record your new holdings of certificates and your new francs on hand. Your holdings of certificates may never go below zero. Your francs on hand may never go below zero.

(3) At the end of the year record your total certificate earnings in the last column of row 19. Compute your end of period totals on row 20 by listing certificate holdings and adding total certificate earnings to your francs on hand.

(4) At the end of the year, subtract from your francs on hand the amount listed in row 21 and enter this new amount on row 22. This is your profit for the market year and is yours to keep. At the end of each market year, record this number on your profit sheet.

(5) At the end of the experiment add up your total profit on your profit sheet and enter this sum on row 15 of your profit sheet. To convert this number into dollars, multiply by the number on row 16 and record the product on row 17. The experimenter will pay you this amount of money.

Market Organization

The market for these certificates is organized as follows. The market will be conducted in a series of years. Each period lasts for seven minutes. Anyone wishing to purchase a certificate is free to raise his or her hand and make a verbal bid to buy one certificate at a specified price, and anyone with certificates to sell is free to accept or not accept the bid. Likewise, anyone wishing to sell a certificate is free to raise his or her hand and make a verbal offer to sell one certificate at a specified price. If a bid or offer is accepted, a binding contract has been closed for a single certificate, and the contracting parties will record the transaction on their

information and record sheets. Any ties in bids or acceptance will be resolved by random choice. Except for the bids and their acceptance, you are not to speak to any other subject. There are likely to be many bids that are not accepted, but you are free to keep trying. You are free to make as much profit as you can.

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1. In instructions for market 2, this sentence was eliminated. In market 1, it had been replaced by "Notice that these amounts may differ from period to period."
2. States and numbers in this paragraph were altered according to parameters for each experiment given in Figure 2.
3. This paragraph describing the clue cards was not used in markets 1 and 2 and was altered to include state Z in market 5.

Trader #_____

INFORMATION AND RECORD SHEET

YEAR _____

	Transaction Number	Transaction Price: Sale	Transaction Price: Purchase	Certificates on Hand	Francs on Hand
Beginning of the Year Holdings	0	//////////	//////////		
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
X-Dividend_____ Y-Dividend_____	19	Total Certificate Earnings Dividend Rate on Hand at the End of the Year			
	20	Total Francs on Hand at the End of the Year			
	21	Less: Fixed Cost			
	22	End of Year Net Profit			

Transfer this amount to your Profit Sheet

Trader #_____

INFORMATION AND RECORD SHEET

YEAR 0

	Transaction Number	Transaction Price Sale	Transaction Price Purchase	Certificates on Hand	Francs on Hand
Beginning of the Year Holdings	0	//////////	//////////	1	1,000,000
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
X-Dividend 10,000 Y-Dividend 30,000	19	Total Certificate Earnings Dividend Rate on Hand at the End of the Year			
	20	Total Francs on Hand at the End of the Year			
	21	Less: Fixed Cost			1,000,000
	22	End of Year Net Profit			

Transfer this amount to your Profit Sheet

Trader #_____

PROFIT SHEET

Row	Market Year	Profit
1	1	
2	2	
3	3	
4	4	
5	5	
6	6	
7	7	
8	8	
9	9	
10	10	
11	11	
12	12	
13	13	
14	14	
15	Total Profit (in Francs)	
16	Dollars Per Franc	0.003
17	Total Dollars Profit	

NAME_____

APPENDIX A.3

INSTRUCTIONS

As you know, each year we draw a ball from a bingo cage (let us call it Cage Z) containing thirty-six balls numbered one through thirty-six. If the ball drawn is numbered one through twelve, X-dividend is paid, if a ball numbered thirteen through thirty-six is drawn, Y-dividend is paid.

If the ball drawn from Cage Z is numbered one through twelve, we go to another bingo cage called Cage X, containing two balls marked I and eight balls marked O. Ten balls are drawn from this cage, one at a time with replacement. Similarly, if the ball drawn from bingo Cage Z is numbered thirteen through thirty-six, we go to a third bingo Cage Y containing four balls marked I and six balls marked O. Again ten balls are drawn, one at a time with replacement from this cage.

Markings on the ten balls drawn from X or Y cages are written down in sequence. A sequence might look like I O O I I O O O I I, which means that the first ball drawn was marked I, the second O and so on. This sequence constitutes your clue. The enclosed sheet is intended to help you get used to identifying whether the clue came from X or Y cage. For each clue shown, you have to record your guess of whether it came from X or Y cage by encircling X or Y on the row. After you have encircled one letter, the correct cage will be revealed. You should then record your wins and losses. Do not erase your guess after it is made since any erasure invalidates the guess.

RECORD SHEET

Period		Events Circle One		Actual Event	Circle one Win or Lose (Cents)	
1	O O I O O O O O I O	X	Y	_____	25	-10
2	O O I O I I O O O I	X	Y	_____	25	-10
3	I O I I O O I O I O	X	Y	_____	25	-10
4	I I O O O I I I I O	X	Y	_____	25	-10
5	O O I O O I I O O I	X	Y	_____	25	-10
6	I O O O O O O I O I	X	Y	_____	25	-10
7	I O O O O I I O O O	X	Y	_____	25	-10
8	I I O I O O I I O O	X	Y	_____	25	-10
9	O O I O O I O O I O	X	Y	_____	25	-10
10	O I O O I I I I I I	X	Y	_____	25	-10
11	O I O O I O O O O O	X	Y	_____	25	-10
12	O O O O O O I I O O	X	Y	_____	25	-10
13	O I O I I O O I O O	X	Y	_____	25	-10
14	I O I I O O O I O I	X	Y	_____	25	-10
15	I O O I O O O I O O	X	Y	_____	25	-10
16	O O O O O O O O I I	X	Y	_____	25	-10
17	O I O O O O O O O O	X	Y	_____	25	-10
18	O O I O I O O O O I	X	Y	_____	25	-10
19	O O O I I O O O O O	X	Y	_____	25	-10
20	O I O O O O I O I O	X	Y	_____	25	-10
21	O O I O O O O O O I	X	Y	_____	25	-10
22	O I O O O I I O I O	X	Y	_____	25	-10
23	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10
24	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10
25	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10
26	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10
27	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10
28	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10
29	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10
30	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10
31	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10
32	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10
33	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10
34	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10
35	_ _ _ _ _ _ _ _ _ _	X	Y	_____	25	-10

Trader # _____

APPENDIX A.4

MARKET 3: POST-EXPERIMENT DEBRIEFING

Please answer the questions below. For every correct answer you get $0.10; for every incorrect answer you lose $0.05.

1. Indicate with a check mark the investors who received blanck/ nonblank clue cards in the years_____ to _____ of the experiment.

Investor	Blank	Nonblank
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		

2. Indicate in the table below the X and Y dividends of other investors.

Investor	X	Y
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		

3. Indicate in the table below the maximum and minimum dividends paid under X and Y.

	State X	State Y
Maximum Dividend		
Minimum Dividend		

Number of Correct Answers_____ Number of Incorrect Answers_____
Net Profit_____

Trader # _____

MARKET 4: POST-EXPERIMENT DEBRIEFING

Please answer the questions below. For every correct answer you get $0.10; for every incorrect answer you lose $0.05.

1. In years _____ through _____, some of the traders knew the state before the trading began (i.e., they received nonblank clue cards), while the other traders did not know the state (i.e., received blank clue cards). Rank all other 11 traders from most likely to be informed (1) to least likely to be informed (11). Cross out your own trader number.

Trader #	Rank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

2. How many traders were informed during the period mentioned in question 1?

3. Indicate in the table below the maximum and minimum dividends paid under states X and Y.

	State X	State Y
Maximum Dividend		
Minimum Dividend		

4. In case you always received a blank clue card, were you able to figure out what the state was from trading? If so, how did you learn the state?

Number of correct answers _____ Number of incorrect answers _____
Net profit _____

Trader # _____

MARKET 5: POST-EXPERIMENT DEBRIEFING

Please answer the questions below. For every correct answer you get $0.10; for every incorrect answer you lose $0.05.

1. In years _____ through _____, some of the traders knew the state before the trading began (i.e., they received nonblank clue cards), while other traders did not know the state (i.e., received blank clue cards). Rank all other 11 traders from most likely to be informed (1) to least likely to be informed (11). Cross out your own trader number.

Trader #	Rank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

2. How many traders were informed during the period mentioned in question 1?

3. Indicate in the table below the maximum and minimum dividends paid under states X and Y.

	State X	State Y
Maximum Dividend		
Minimum Dividend		

APPENDIX B
BIDS, OFFERS, PRICES

MARKET 1

YEAR 1

B.N.	Buyer	Seller	Bid	Offer	Price
1	1		50		
2		3		300	
3	2		200		
4	2		250		
5	5		275		
6	5	9			275
7	8		240		
8		2		285	
9	3	2			285
10	8		250		
11	8	1			250
12	7		180		
13		7		180	
14		4		275	
15	7		225		
16	7	6			225
17	9		200		
18	9	8			200
19	4		210		
20	4	6			210
21		4		250	
22	2	4			250
23	1		200		
24	1	3			200
25		8		200	
26	1	8			200
27	4		200		
28		7		250	
29	2	7			250
30	4		225		
31		9		250	
32	5	9			250
33	1		200		
34	2		225		
35	4		240		
36	4	3			240
37	8		200		
38	1		210		
39		2		260	
40		3		250	
41	5	3			250
42	1		210		
43		2		260	
44	4	2			260
45	1		250		
46	1	7			250
47	8		200		
48		4		250	
49	5	4			250
50	8		200		
51	1		210		
52	8		225		
53	8	9			225

YEAR 2

B.N.	Buyer	Seller	Bid	Offer	Price
1	8		225		
2		3		280	
3	4		240		
4	5		250		
5	5	6			250
6		3		280	
7	8		225		
8	2		250		
9		3		260	
10	5		255		
11	5	6			255
12		3		265	
13	8	3			265
14	1		215		
15		7		275	
16	2		250		
17		3		270	
18	2		255		
19	8		260		
20	8	9			260
21	1		250		
22		3		270	
23	2		255		
24	2	7			255
25		4		265	
26	8		260		
27	8	3			260
28	1		255		
29	5		260		
30	5	4			260
31	2		260		
32		7		280	
33	1		270		
34		2		275	
35	1	2			275
36		7		280	
37	6		270		
38	1		275		
39	1	7			275
40	8		260		
41	4		265		
42	6		270		
43		2		280	
44	1		275		
45	1	8			275
46	5		260		
47	5	7			260
48	2		250		
49	6		255		
50	4		260		
51		5		280	
52	6		270		
53		8		275	
54	6	8			275
55	5		255		
56	1		260		
57	4		265		
58		2		285	
59	1		270		
60	1	7			270
61		2		285	
62	8		260		
63	8	7			260

YEAR 3

B.N.	Buyer	Seller	Bid	Offer	Price
1	4		250		
2		3		285	
3	8		255		
4	4		260		
5	4	8			260
6	2		255		
7		3		275	
8	2		260		
9	2	7			260
10	8		250		
11	8	4			250
12	2		250		
13	3		255		
14	1		260		
15	1	6			260
16		3		270	
17	2		255		
18	4		260		
19	1		265		
20	1	9			265
21	5		260		
22	4		265		
23		2		275	
24		8		270	
25	7	8			270
26	2		260		
27	3		265		
28	4		270		
29		2		280	
30	8		271		
31	4		275		
32	4	3			275
33	8		270		
34		2		285	
35		3		280	
36	1		275		
37	6	3			280
38	8		265		
39	4		270		
40	8		275		
41		5		280	
42	2	5			280
43	8		275		
44	4		280		
45	4	7			280
46	4		260		
47	8		270		
48		2		285	
49	1		275		
50		9		280	
51	8	9			280
52	4		270		
53		2		285	
54	4		275		
55	8		280		
56	8	5			280
57	4		275		
58		2		290	
59		8		285	
60	7	8			285
61	1		265		
62		2		285	
63	8		275		
64	4		280		
65	4	7			280

YEAR 4

B.N.	Buyer	Seller	Bid	Offer	Price
1		4		290	
2	8		270		
3		3		285	
4		4		280	
5	8		275		
6	8	7			275
7	2		260		
8	3		265		
9		4		280	
10	8		270		
11	1		275		
12	1	4			275
13	3		260		
14	8		265		
15	5		270		
16	8		275		
17		3		285	
18	6		280		
19	6	1			280
20	8		275		
21		2		285	
22	8		280		
23	8	5			280
24		3		285	
25	2		260		
26	4		265		
27	3		270		
28	8		275		
29		3		280	
30	2	3			280
31	8		275		
32		8		285	
33		3		280	
34	2	3			280
35	4		260		
36	1		265		

37	4		270		
38	2		275		
39	7		280		
40	7	9			280
41	8		275		
42		1		300	
43	2		280		
44		8		295	
45	7		285		
46	7	1			285
47	8		280		
48		4		290	
49		9		285	
50	8	4			280
51	1		250		
52	4		260		
53	5		275		
54	2		280		
55	2	9			280
56	1		260		
57	4		265		
58		8		280	

YEAR 5

S.N.	Buyer	Seller	Bid	Offer	Price
1	2		260		
2		3		310	
3		7		300	
4	4		275		
5		2		285	
6	4	2			285
7		3		310	
8		8		300	
9	4		260		
10	1		265		
11		9		295	
12	8		270		
13	4		275		
14	6		280		
15		3		290	
16	4	3			290
17	7		285		
18		1		300	
19		8		295	
20		6		290	
21	1	6			290
22		2		300	
23	4		280		
24		8		295	
25	2		265		
26	2	9			285
27		3		300	
28		2		280	
29	1	2			280
30		5		285	
31	4	5			285
32	3		275		
33	7		285		
34		8		290	
35	7	8			290
36	4		285		
37		3		290	

38	1		286		
39	4	3			290
40		2		295	
41		5		290	
42	4		280		
43	3		265		
44	3	9			285
45	4		280		
46		3		290	
47	8	3			290
48	4		285		
49		7		290	
50	1	7			290
51	4		285		
52		8		295	
53	4		290		
54	4	5			290
55	3		280		
56		2		295	
57	4		285		
58		6		290	
59	4	6			290
60	3		280		
61	4		285		
62		2		295	
63	8		290		
64	8	7			290
65	4		290		
66		2		295	
67	4	2			295
68	3		280		
69		8		295	
70	4		290		
71	4	8			295
72	4		285		
73	7		295		
74		8		300	
75	7	8			300
76	1		290		

YEAR 6

S.N.	Buyer	Seller	Bid	Offer	Price
1		4		310	
2		3		305	
3	8		275		
4		4		300	
5		2		295	
6	3		280		
7	9		285		
8		4		290	
9	1	4			290
10		2		295	
11	3		280		
12	1		285		
13	6		290		
14	6	7			290
15	8		285		
16		2		295	
17		1		290	
18	5	1			290
19		3		300	

20	8		280		
21	4		285		
22		9		295	
23	1		290		
24	1	2			290
25	8		285		
26		3		295	
27		9		290	
28	1	9			290
29	4		280		
30	8		285		
31		3		295	
32	6		290		
33	6	3			290
34		3		300	
35		4		295	
36	8		290		
37	8	3			290
38		4		295	
39	3		285		
40	1		290		
41	1	7			290
42		4		295	
43	8		285		
44		9		290	
45	2		286		
46	1	9			290
47		4		290	
48	3		280		
49	8		285		
50	8	4			285
51	3		280		
52	2		285		
53		1		300	
54		5		295	
55		8		290	
56	5	8			290
57	5		290		
58		2		295	
59	5	2			290

YEAR 7

S.N.	Buyer	Seller	Bid	Offer	Price
1	4		280		
2		8		310	
3	2		285		
4		3		305	
5		8		300	
6	1		290		
7	1	9			290
8		8		305	
9	4		290		
10	2		295		
11	2	5			295
12	4		295		
13		3		300	
14	4	3			300
15	4		290		
16	8		295		
17		5		300	
18	7	5			300
19	4		290		
20	2		295		

21		8		305	
22	4		300		
23	4	6			300
24	2		295		
25		3		310	
26		8		305	
27	4		300		
28	4	3			300
29	2		295		
30		8		300	
31	4	8			300
32	1		290		
33	3		295		
34		2		305	
35	1		300		
36	1	9			300
37	4		295		
38		8		300	
39	4	8			300
40	7		300		
41		2		305	
42	1	2			305
43	4		300		
44		6		305	
45	4	6			305
46	2		310		
47	4		300		
48	4		305		
49	4	7			305
50		2		310	
51	9		300		
52	4		305		
53	4	2			305
54	1		290		
55	8		295		
56	4		300		
57		2		310	
58	4		305		
59	4	2			305
60	4		300		
61	1		305		
62	4		310		

YEAR 8

S.N.	Buyer	Seller	Bid	Offer	Price
1	1		250		
2		3		310	
3		4		305	
4	3		270		
5	8		275		
6	7		280		
7		3		300	
8	3		285		
9		2		295	
10	8		290		
11	8	1			290
12	2		250		
13	3		280		
14		2		295	
15	6		285		
16		2		290	
17	5	2			290
18	1		250		
19	3		280		

20	8		285		
21		2		295	
22		9		290	
23	5	9			290
24		3		295	
25	8		280		
26	5		285		
27		2		290	
28	6	2			290
29		4		290	
30	7	4			290
31		8		295	
32	2		260		
33	4		270		
34		3		290	
35	5	3			290
36		8		295	
37	2		260		
38	3		280		
39	5		285		
40		1		290	
41	5	1			290
42		8		295	
43		4		290	
44	2		270		
45	5		280		
46	5		285		
47	5	3			285
48		4		290	
49	2		260		
50	8		270		
51	5		280		
52		4		285	
53	5	4			285
54	2		260		
55		8		300	
56		8		295	
57	7	8			295

YEAR 9

S.N.	Buyer	Seller	Bid	Offer	Price
1	4		280		
2		8		305	
3	2		265		
4	4		290		
5		3		300	
6	7	3			300
7		8		305	
8	1		290		
9	4		300		
10	4	9			300
11	4		295		
12	8		300		
13	8	1			300
14	4		300		
15		9		305	
16	4	5			300
17	3		290		

18	4		295		
19		3		305	
20	1		300		
21	1	6			300
22		8		305	
23	1		280		
24	4		300		
25	4	8			300
26	7		290		
27	1		300		
28	1	4			300
29		3		310	
30		2		305	
31	4	2			305
32		5		305	
33	7	5			305
34	4		305		
35	4	6			305
36		3		310	
37	4		305		
38	4	9			305
39	8		280		
40	3		290		
41	4		300		
42	1		301		
43	4		305		
44	4	2			305
45		3		310	
46	7		300		
47	1		305		
48	4	3			310
49	4		300		
50	7		310		
51	1		315		
52	4		320		
53	4		325		
54	4		330		
55		7		340	
56	4	7			340
57	3		280		
58	8		285		
59	1		310		
60	4		320		
61	4		330		
62		7		340	
63	1	7			340
64	4		340		
65	4	7			340
66	4		345		

YEAR 10

S.N.	Buyer	Seller	Bid	Offer	Price
1		3		340	
2	8		260		
3	3		270		
4	2		275		
5	4		280		
6		3		330	
7		8		325	

8		9		300	
9	5		285		
10	2		290		
11	8		295		
12	3	9			300
13	4		295		
14		8		310	
15	3		300		
16	4		305		
17	4	8			310
18		2		315	
19	1		280		
20	3		300		
21	4		310		
22	3	2			315
23		8		320	
24	4		315		
25	4	9			315
26		8		320	
27	1		315		
28	1	6			315
29	4		315		
30		2		340	
31	3		320		
32		3		325	
33	4	3			325
34		8		350	
35	4		310		
36		3		325	
37	4	3			325
38	3		310		
39	4		320		
40		8		330	
41	1		325		
42	4	8			330
43	3		325		
44	4		330		
45	4	3			330
46	8		310		
47		7		340	
48	4		330		
49	4	3			330
50	1		310		
51		5		335	
52	2		315		
53	4	5			335
54		2		340	
55	4		335		
56	4	6			335
57		5		340	
58	1		335		
59	4	5			340
60		2		340	
61	4	2			340
62		7		340	
63	4	7			340
64	4		340		
65		7		345	
66	4	7			345
67		1		345	
68	4	1			345
69	3		280		

YEAR 11

S.N.	Buyer	Seller	Bid	Offer	Price
1		3		350	
2	8		260		
3	3		300		
4	3	9			300
5	7		310		
6	4		315		
7	3		320		
8		3		350	
9	3		325		
10	4		330		
11		5		345	
12	1	5			345
13	3		330		
14	4		340		
15		8		360	
16	3		345		
17		2		355	
18	3		350		
19	3	7			350
20		8		360	
21	4		350		
22	4	1			350
23		8		360	
24	4		350		
25	4	1			350
26		2		365	
27		3		360	
28	4		350		
29		3		355	
30	4	2			350
31		8		360	
32		3		355	
33	4		350		
34	4	6			350
35		3		355	
36	8	3			355
37		2		360	
38	4		350		
39		3		355	
40	4	9			350
41	4		350		
42		3		355	
43	4	7			350
44		6		355	
45		8		350	
46		6		345	
47	4	6			345
48		8		355	
49		2		350	
50	1		345		
51	4	2			350
52		8		355	
53	4		350		
54	4	3			350
55		8		355	
56	4		350		
57	4	3			350
58		8		360	

59	4		350		
60	4	1			350
61		3		355	
62		8		350	
63	4	8			350
64		3		355	
65		8		350	
66	1		345		
67	1	3			345
68		8		355	
69		5		350	
70	4	5			350
71		8		360	
72		1		355	
73		8		350	
74	4		345		
75	4	8			345
76		1		350	
77		8		345	

MARKET 2

YEAR 1

S.N.	Buyer	Seller	Bid	Offer	Price
1	1		300		
2		3		700	
3		2		500	
4	4		350		
5	4	8			350
6		3		450	
7		2		400	
8		12		350	
9	1		300		
10	1	10			300
11		3		350	
12	11		250		
13		2		325	
14		7		300	
15	11	3			250
16		12		275	
17	1		240		
18	1	8			240
19		3		300	
20	11		200		
21	4		225		
22	4	3			225
23	1		200		
24	1	6			200
25	3		150		
26	11		175		
27	8		200		
28		4		300	
29		10		280	
30	11		220		
31		4		270	
32	7		250		
33	7	9			250
34	8		250		
35	8	12			250
36		4		300	
37	3		175		
38		8		250	
39	10	9			250
40		4		275	
41		12		250	
42	1		200		
43	6		220		
44	10		240		
45	10	12			240
46	11		200		
47	8		240		
48		4		260	
49	8		250		
50	8	2			250
51	1		230		
52		11		275	
53		6		250	

YEAR 2

S.N.	Buyer	Seller	Bid	Offer	Price
1		3		350	
2		9		300	
3	11		200		
4	6		220		
5		3		290	
6	11		225		
7		9		280	
8		12		250	
9	10	12			250
10	11		200		
11		2		260	
12		3		255	
13	11		225		
14	8		240		
15	8	9			240
16	1		220		
17	11		230		
18	2		240		
19		3		280	
20	7		250		
21	7	3			250
22	8		240		
23		4		260	
24		9		250	
25	2	9			250
26		3		275	
27	11		250		
28	11	12			250
29	11		200		
30		3		260	
31	11		240		
32	1		245		
33		2		255	
34		3		253	
35	11		250		
36	10	3			253
37		4		270	
38	11		230		
39	8		240		
40		4		260	
41	11		250		
42		4		258	
43	7		252		
44	10		253		
45	11		254		
46	11	4			254
47	1		250		
48	8		255		
49		4		270	
50	11		256		
51	10		260		
52		11		269	
53	10	8			260
54	1		250		

YEAR 3

S.N.	Buyer	Seller	Bid	Offer	Price
1	1		220		
2	8		240		
3		3		280	
4		9		270	
5		4		265	
6	8		250		
7		3		262	
8	7		255		
9	7	3			255
10		9		260	
11	1		250		
12	10		255		
13	10	9			255
14		3		270	
15		12		260	
16	1		255		
17	1	3			255
18	8		250		
19		12		260	
20	8		255		
21	8	9			255
22	1		255		
23		12		260	
24	1	6			255
25	7		255		
26	10		257		
27	10	12			257
28	7		255		
29	11		257		
30	11	4			257
31		8		260	
32	11		255		
33	10		257		
34	10	12			257
35	3		250		
36	8		255		
37	11		257		
38	11	6			257
39	3		245		
40	7		255		

41		4		265	
42	1		257		
43	10		259		
44	7		260		
45	7	8			260
46	1		260		
47		4		268	
48		11		265	
49	10		262		
50	10	2			262
51	3		250		
52	8		260		
53		11		265	
54	6	11			265
55	8		260		
56		4		268	
57	1		265		
58	1	4			265
59	11		255		
60		6		260	
61	10	6			260

YEAR 4

S.N.	Buyer	Seller	Bid	Offer	Price
1	8		240		
2	3		245		
3	7		250		
4		9		270	
5	3		255		
6		9		265	
7	11		260		
8	11	12			260
9	3		250		
10	4		255		
11	8		260		
12	8	3			260
13	7		260		
14	3		262		
15		2		264	
16	11	2			264
17		9		265	
18	1		260		
19	1	6			260
20	8		260		
21		3		280	
22		9		265	
23	5	9			265
24		12		280	
25	3		255		
26	8		265		
27	8	3			265
28		9		270	
29	4		265		
30		12		267	
31	11	12			267
32	3		260		
33		2		267	
34	1		265		
35	7	2			267
36		9		270	
37	11		267		
38	11	6			267
39	8		260		

40	3		262		
41	4		265		
42	11		267		
43		4		270	
44		9		269	
45	1		268		
46	1	10			268
47		6		270	
48	4		265		
49		9		269	
50		6		268	
51	11		267		
52	11	9			267
53	4		263		
54	1		265		
55		6		266	
56	1	6			266
57		8		270	
58		4		268	
59	11		250		
60	7		255		
61	10		260		
62	7		262		
63	10		265		

YEAR 5

S.N.	Buyer	Seller	Bid	Offer	Price
1	8		150		
2		3		320	
3	10		250		
4	11		255		
5	2		260		
6	2	12			260
7	11		255		
8	10		260		
9	8		265		
10		3		272	
11	2	3			272
12	8		270		
13	7		275		
14		12		300	
15	8		280		
16	10		290		
17	10	9			290
18		12		300	
19	7	12			300
20		6		300	
21	1	6			300
22	8		290		
23		3		330	
24	10		300		
25	7		310		
26	7	2			310
27		3		340	
28	1		305		
29	1	2			305
30		3		325	
31	10		310		
32	10	5			310
33	1		305		
34	1	8			305
35	4		300		
36		3		320	

37	10		310		
38	10	2			310
39		3		315	
40	1		310		
41	1	8			310
42		6		313	
43	10		310		
44	10	11			310
45		3		312	
46	4		310		
47	4	2			310
48	1		310		
49	1	9			310
50		3		311	
51	10	3			311
52	1		310		
53	1	6			310
54	7		310		
55	7	8			310
56	4		310		
57	4	11			310
58	1		310		
59	10		312		
60	10	8			312
61	1		315		
62	1	5			315
63	10		312		
64	4		313		
65	10		315		
66	4		316		
67		1		350	
68	10		320		
69	4		325		
70	10		330		
71	4		335		
72	10		340		
73	1		345		

YEAR 6

S.N.	Buyer	Seller	Bid	Offer	Price
1	4		260		
2		3		380	
3	11		270		
4	8		280		
5	10		300		
6		3		370	
7		2		350	
8		6		330	
9	7	6			330
10		2		325	
11	1	2			325
12		2		325	
13	1	2			325
14	1		325		
15	1	8			325
16		3		365	
17	10		330		
18	10	5			330
19	7		330		
20	1		335		
21	1	6			335
22	10		330		
23		3		355	
24	4		335		

25	4	8			335
26	1		330		
27	10		335		
28	10	11			335
29	1		335		
30		3		350	
31	10		340		
32	10	11			340
33	9		330		
34	1		335		
35	4		337		
36	7		340		
37	7	12			340
38		3		348	
39	4		345		
40		3		347	
41	4	3			345
42	8		340		
43		3		350	
44	1		343		
45	1	5			343
46	4		340		
47	1		343		
48	10		345		
49		3		349	
50	4		346		
51	4	9			346
52		3		349	
53	10		345		
54	10	9			345
55	1		345		
56		3		347	
57	1	3			347
58		12		350	
59	4		345		
60	4	12			345
61	1		345		

YEAR 7

S.N.	Buyer	Seller	Bid	Offer	Price
1		3		380	
2		2		350	
3		8		340	
4	1		320		
5	1	7			320
6	9		320		
7	9	11			320
8		3		375	
9		8		360	
10	2		345		
11		2		345	
12		12		340	
13		6		330	
14		12		320	
15	3	12			320
16		7		310	
17	4	7			310
18		2		325	
19		9		320	
20		8		315	
21		2		310	
22	3		260		
23		6		300	
24	2	6			300

25		12		340	
26		8		320	
27	10		300		
28	4		305		
29	4	2			305
30		9		320	
31	10		310		
32	10	8			310
33		2		315	
34	10		310		
35		2		314	
36		2		310	
37	10	2			310
38		3		330	
39	4		300		
40		12		329	
41		3		325	
42		9		320	
43	10		310		
44	10	6			310
45	4		~~300~~		
46		9		315	
47	10		310		
48	10	8			310
49		3		320	
50		4		315	
51	10		310		
52	10	1			310
53	8		310		
54	8	3			310
55		9		310	
56	10	9			310
57		2		310	
58		3		305	
59	10	3			305
60	4		300		
61	6		303		
62		1		305	
63	6	3			303
64		9		300	
65	10	9			300
66		1		300	
67	8	1			300
68		2		300	
69	5	2			300
70		9		300	
71	4	9			300
72		1		300	
73	5	1			300
74		11		300	
75	10	11			300
76		12		310	
77	6	12			310
78	10		300		

YEAR 8

S.N.	Buyer	Seller	Bid	Offer	Price
1		6		350	
2	1		250		
3	4		275		
4	3		300		
5		2		340	
6		8		320	
7	3	8			320
8		2		325	
9	1	2			325
10		12		340	
11	4		310		
12		2		325	
13	7	2			325
14		12		340	
15	4		320		
16		8		330	
17	1		325		
18	1	6			325
19	7		326		
20		3		348	
21		12		340	
22	4		330		
23	4	12			330
24		3		350	
25		6		340	
26	1		330		
27	1	8			330
28	4		325		
29	7		330		
30	7	11			330
31		3		350	
32	1		330		
33		3		347	
34		12		345	
35	4		332		
36	4	6			332
37	7		335		
38	7	5			335
39	1		335		
40		3		347	
41		10		340	
42	4		336		
43		12		337	
44	1	12			337
45		3		347	
46		9		340	
47	1	9			340
48		10		340	
49	1	10			340
50		11		340	
51	1		335		
52	1	10			335
53		3		345	
54		4		340	
55	1		335		
56	1	3			335
57		3		345	
58		4		340	
59	1		310		
60	8		320		
61	4		330		
62	4	11			330
63		9		340	
64	1		330		
65		3		335	
66		3		333	
67	1	9			330
68		3		335	
69	1		310		
70		4		333	
71		3		330	
72	1		315		
73	1	3			315
74	1		315		
75	1	5			315
76		3		330	
77	1		310		
78	1	3			310
79	1		300		
80	4		310		

YEAR 9

S.N.	Buyer	Seller	Bid	Offer	Price
1	4		300		
2		2		350	
3		6		345	
4	3		310		
5		8		340	
6	4		315		
7		2		330	
8	3		320		
9		7		325	
10	4	7			325
11		2		~~325~~	
12	3		300		
13	4		310		
14		1		320	
15	3	1			320
16		8		330	
17		11		325	
18	4		310		
19		2		320	
20		8		315	
21	4	8			315
22		2		315	
23		7		310	
24	4		300		
25	4	7			300
26		3		335	
27		10		315	
28		8		310	
29		2		305	
30		10		300	
31	5	10			300
32		1		300	
33	4		285		
34		6		295	
35	4	6			295
36		8		310	
37		11		300	
38	4		285		
39		10		290	
40	4	1			285
41		3		320	
42		8		300	
43		10		290	
44	4		280		
45		10		285	
46	4	5			280
47		6		290	
48		10		280	
49		9		275	
50		10		270	
51	4		260		
52	4	2			260
53		3		300	
54		8		280	
55		10		275	
56		10		260	
57		8		255	
58		10		240	
59	11		150		
60	3		230		
61	3	10			230
62	3		230		
63	3	2			230
64	3		230		
65	3	8			230
66	4		230		
67	4	11			230
68	3		230		
69		11		270	
70	4		235		
71		12		260	
72		9		250	
73		6		245	
74	4		240		
75	4	5			240
76		12		240	
77	3	12			240
78		11		235	
79		6		230	
80	3	6			230
81		11		230	
82	3	11			230
83	12		235		

YEAR 10

S.N.	Buyer	Seller	Bid	Offer	Price
1		8		350	
2		6		330	
3	1		300		
4	9		320		
5	9	2			320
6	7		320		
7	7	8			320
8	1		320		
9	1	6			320
10	3		322		
11	3	4			322
12	1		320		
13	1	8			320
14	10		320		
15	10	6			320
16	1		320		
17	7		325		
18	7	2			325
19	1		330		
20		3		345	
21	10		335		
22	10	11			335
23	1		335		
24		3		345	
25		4		340	
26	7		342		
27	7	12			342
28		9		340	
29	1	9			340
30		3		345	

31	1		340		
32		4		343	
33	1	3			340
34	1		340		
35	1	12			340
36		3		345	
37	1		325		
38	4		330		
39		5		340	
40	1		335		
41		11		339	
42		5		338	
43	1	9			335
44		3		347	
45	4		325		
46		3		343	
47		9		337	
48	1		330		
49		11		335	
50	1	3			330
51	1		330		
52	1	5			330
53		3		340	
54		9		330	
55	1		315		
56	4		320		
57		3		329	
58	1		325		
59	1	5			325
60		3		330	
61	4		315		
62	1		320		
63	1	9			320
64		3		325	
65	4		315		
66	1		320		
67	1	11			320
68		3		320	
69	1		315		
70	1	3			315
71	4		310		

YEAR 11

S.N.	Buyer	Seller	Bid	Offer	Price
1		8		340	
2	3		290		
3		2		330	
4	4		300		
5	7		320		
6	4		325		
7	4	2			325
8	7		325		
9	7	8			325
10	1		325		
11	1	6			325
12	9		325		
13	9	6			325
14	1		325		
15	3		326		
16		12		330	
17	1	12			330
18		2		330	
19	1	2			330
20		11		330	
21	10	11			330
22		8		330	
23	1	8			330
24		9		340	
25	4		330		
26	3		331		
27	4		335		
28	4	3			335
29		9		340	
30	1		335		
31	7	9			340
32		12		345	
33		9		340	
34	1	9			340
35		3		340	
36	1	3			340
37		4		340	
38	1	4			340
39		11		340	
40	10	11			340
41		5		345	
42		4		340	
43	10	4			340
44	3		320		
45		9		345	
46	1		335		
47		5		344	
48	7		340		
49	7	12			340
50	1		340		
51		9		343	
52		9		342	
53	1	5			340
54	1		340		
55	3		341		
56	3	9			341
57		3		345	
58	1		340		
59		3		344	
60		3		342	
61	1	5			340
62		3		341	
63	1		335		
64	7		340		
65	7	3			340
66	4		335		
67	1		340		

MARKET 3

YEAR 1

S.N.	Buyer	Seller	Bid	Offer	Price
1	11		200		
2		8		300	
3		3		250	
4	10	3			250
5		3		280	
6	11		210		
7		2		270	
8		8		260	
9		12		250	
10	4		230		
11	4	6			230
12	11		230		
13		2		280	
14		5		250	
15	11	5			250
16		12		260	
17		7		250	
18		12		240	
19	1	12			240
20		3		250	
21		7		240	
22	10	7			240
23	12		230		
24		3		250	
25	4		235		
26	4	8			235
27	12		230		
28	7		240		
29	7	12			240
30	12		210		
31		2		260	
32	1		220		
33	12		230		
34		7		240	
35	11		235		
36	11	3			235
37	12		230		
38		7		240	
39		4		239	
40		7		235	
41	4		231		
42	4	7			231
43	12		220		
44		9		240	
45		7		235	
46	4		221		
47		2		230	
48	10	2			230
49		7		230	
50	11	7			230
51		9		235	
52		6		230	
53	4		200		
54	4	2			200

YEAR 2

S.N.	Buyer	Seller	Bid	Offer	Price
1	2		150		
2	12		175		
3	11		180		
4		3		240	
5	8		200		
6	8	5			200
7		12		230	
8		3		225	
9	11	3			225
10	2		180		
11	12		190		
12		9		240	
13	10		220		
14	10	4			220
15	12		210		
16		7		230	
17	2		215		
18	12		220		
19	12	8			220
20	7		200		
21		12		230	
22	10		220		
23	10	9			220
24	11		215		
25	2		220		
26	2	6			220
27		8		230	
28	7		210		
29		4		230	
30	2		220		
31	10		225		
32	10	3			225
33		12		230	
34		7		225	
35	2		220		
36	2	12			220
37		9		230	
38	11		215		
39		8		225	
40		7		224	
41	11		216		
42	10		220		
43	10	12			220
44	2		210		
45		12		225	
46	11		215		
47		12		220	
48	2	12			220
49		9		230	
50		8		225	
51		7		224	
52	12		210		
53	11		220		
54	11	6			220
55	12		200		
56	2		205		
57	12		210		
58		7		225	
59		8		220	
60	7		215		
61	7	8			215
62		9		220	
63	7		210		
64	11		211		
65	7		212		
66		4		215	
67	2	4			215
68	7		210		
69	7	9			210
70	11		200		
71	7		205		
72		8		210	
73	7	8			210

YEAR 3

S.N.	Buyer	Seller	Bid	Offer	Price
1	3		150		
2	11		160		
3		12		250	
4		7		220	
5		5		200	
6	10	5			200
7		3		220	
8	7		180		
9	8		190		
10	2		195		
11	10		200		
12	10	1			200
13	12		200		
14		2		300	
15		3		220	
16	10		210		
17	10	11			210
18		7		215	

19	12		190		
20	2		200		
21	2	3			200
22	11		200		
23	11	1			200
24		12		220	
25		7		205	
26	2		190		
27	10	7			205
28	12		190		
29		4		210	
30		7		205	
31		3		200	
32		7		195	
33	8	7			195
34		3		195	
35	2	3			195
36		12		210	
37		4		200	
38	2		180		
39		5		195	
40	12		185		
41	7		186		
42		12		190	
43	10	12			190
44		12		200	
45	2		190		
46	2	11			190
47		12		200	
48		5		195	
49		6		190	
50	2		160		
51	12		165		
52		12		185	
53	3		170		
54	2		175		
55	2	8			175
56	3		165		
57		12		180	
58		5		175	
59	3		170		
60	3	11			170
61		12		175	
62	2		150		
63	3		160		
64	2		165		
65	2	5			165
66	3		165		
67	3	12			165
68	3		165		
69		9		190	
70		4		185	
71		9		180	
72	3		170		
73	3	6			170

YEAR 4

S.N.	Buyer	Seller	Bid	Offer	Price
1	7		220		
2	11		230		
3	7		250		
4		2		290	
5		3		280	
6	11		260		
7	11	12			260
8	7		275		
9	7	3			275
10		9		275	
11	7	9			275
12	2		260		
13		3		280	
14	7	3			280
15	11		265		
16	7		270		
17	10		275		
18	11		276		
19		12		290	
20	4	12			290
21	11		277		
22	10		280		
23		6		300	
24	7	6			300
25	12		280		
26	10		290		
27	12		295		
28		2		310	
29	1	2			310
30	12		300		
31		6		350	
32		8		340	
33	4	8			340
34	7		310		
35	10		320		
36	10	5			320
37	7		325		
38	12		330		
39		6		350	
40	1	6			350
41		9		350	
42	4	9			350
43		11		360	
44	1	11			360
45	10		350		
46		2		360	
47	7	2			360
48		8		360	
49	10	8			360
50		11		400	
51	10		350		
52	1		360		
53	1	5			360
54		11		365	
55	4	11			365
56	10		360		
57	1		365		
58		11		390	
59	10		380		
60		11		385	
61	7	11			385
62	1		380		
63	7		385		
64	1		390		
65	1	4			390
66	7		380		
67	1		390		
68	7		391		
69		4		395	
70	7	4			395
71	1		390		
72	7		395		

YEAR 5

S.N.	Buyer	Seller	Bid	Offer	Price
1		7		250	
2	3		150		
3	3	1			150
4		7		220	
5	3		120		
6	2		150		
7	2	7			150
8	3		150		
9	3	1			150
10	6		150		
11	12		155		
12	10		160		
13	12		165		
14		9		200	
15		12		195	
16	10		175		
17	10	11			175
18	2		150		
19	12		155		
20	3		160		
21		5		180	
22	10		175		
23	10	7			175
24	12		160		
25	3		165		
26		5		175	
27	2		170		
28	2	12			170
29		5		175	
30	12		160		
31	12	4			160
32	3		155		
33		12		170	
34	3		160		
35	3	8			160
36		12		170	
37	2		160		
38	2	4			160
39	6		160		
40		12		165	
41	6	12			165
42	3		160		
43		12		170	
44		11		169	
45		12		165	
46	10	12			165
47		5		165	
48	6	5			165
49	3		165		
50	3	5			165
51	2		145		
52		11		170	
53	6		150		
54		8		165	
55	3	8			165
56	2		155		
57	6		160		
58		11		169	
59	6		165		
60	6	11			169
61	3		165		
62		9		200	
63		9		180	
64	6		170		

YEAR 6

S.N.	Buyer	Seller	Bid	Offer	Price
1	11		150		
2		7		225	
3	10		200		
4	10	5			200
5		7		210	
6		1		200	
7		7		195	
8	2		190		
9	2	7			190
10		1		200	
11		3		195	
12	12		175		
13	12	7			175
14	2		155		
15		9		200	
16	10		180		
17	10	1			180
18		12		200	
19		3		190	
20	12		170		
21	10		175		
22	10	8			175
23	2		130		
24		12		190	
25		1		180	
26	3		150		
27		8		170	
28	2		155		
29	3		160		
30	3	4			160
31		1		165	
32	12	1			165
33	2		155		
34	3		160		
35		8		170	
36	12		165		
37	12	8			165
38	3		165		
39	3	5			165
40	12		160		
41	6		165		
42	6	4			165
43		12		180	
44	12		160		
45	6		165		
46		12		175	
47	3		170		
48		11		174	
49	3	12			170
50	2		165		
51		12		175	
52	6		170		
53	6	12			170
54	3		165		
55		12		175	
56			170		
57	2	11			170
58		12		175	
59	3		170		

60	3	11			170
61	2		165		
62		9		180	
63		12		175	
64	6		170		

YEAR 7

S.N.	Buyer	Seller	Bid	Offer	Price
1		3		250	
2	11		200		
3	11	6			200
4	10		200		
5	7		205		
6	12		210		
7	7		220		
8	5		230		
9	11		235		
10	12		240		
11	12	3			240
12	4		225		
13		2		310	
14	4	2			310
15	10		200		
16		6		400	
17		2		390	
18	11		260		
19	10		270		
20	7		280		
21	12		290		
22		12		340	
23	7	12			340
24	1		300		
25	10		320		
26		2		400	
27	12		340		
28	12	5			340
29		9		375	
30	1	9			375
31		2		410	
32	12		340		
33	7		370		
34	7	12			370
35	10		370		
36	11		375		
37		11		400	
38	1		380		
39		2		390	
40	10	2			390
41		3		400	
42		12		395	
43	1	12			395
44		3		395	
45	10	3			395
46		5		400	
47		9		390	
48	7	9			390
49		11		395	
50	7	11			395
51		12		400	
52		8		395	
53	1	8			395
54		5		395	
55	10	5			395
56		12		395	
57	1	12			395
58		8		395	
59	7	8			395
60		11		399	
61	1		390		
62	10		395		
63	4	11			399
64	4		399		
65	4	6			399
66		11		400	
67	4		399		
68	4	11			399
69	4		398		

YEAR 8

S.N.	Buyer	Seller	Bid	Offer	Price
1	12		175		
2	12	5			175
3		7		175	
4		1		170	
5		7		165	
6	6	7			165
7	12		160		
8	12	1			160
9	3		150		
10	3	7			150
11	3		150		
12	12		155		
13	6		160		
14	6	8			160
15	12		160		
16		10		170	
17	6		165		
18	6	4			165
19	12		160		
20	3		165		
21	3	10			165
22	12		165		
23	12	5			165
24		4		170	
25	12		165		
26	12	8			165
27	3		160		
28		2		175	
29	6		165		
30	6	10			165
31	3		165		
32		4		169	
33	6		166		
34		11		168	
35	6	11			168
36	12		165		
37	3		170		
38	3	4			170
39		12		175	
40	2		150		
41	12		155		
42	3		160		
43	6		165		
44		2		170	
45	3	2			170
46	12		165		
47	9		170		
48		2		190	
49		12		180	
50		2		175	
51		11		174	
52	6		171		
53	6	11			171
54	3		170		
55		12		180	
56		2		175	

YEAR 9

S.N.	Buyer	Seller	Bid	Offer	Price
1	11		200		
2		12		395	
3	1		220		
4	11		230		
5	7		250		
6	8		300		
7	1		320		
8	12		330		
9	4		360		
10	12		370		
11	7		390		
12	7	5			390
13		2		395	
14	1	2			395
15		3		450	
16		6		395	
17	10	6			395
18		11		400	
19	12		390		
20	1		395		
21		9		399	
22	1	12			395
23	7		395		
24		2		420	
25		12		400	
26		8		395	
27	7	8			395
28	1		395		
29		2		399	
30		6		397	
31	7	6			397
32		3		400	
33		2		399	
34		9		397	
35	7	9			397
36		8		397	
37	7	8			397
38		2		398	
39	7	2			398
40		11		399	
41	10		395		
42	10	12			395
43		3		395	
44	1	3			395
45	7		395		
46	7	5			395
47	7		395		
48	1		397		
49	1	11			397
50	10		395		
51	1		397		
52	1	3			397
53	7		396		
54	1		397		
55	1	9			397
56	7		397		
57	4		398		
58	7		399		
59	7	11			399

YEAR 10

S.N.	Buyer	Seller	Bid	Offer	Price
1		7		350	
2	2		150		
3	3		165		
4		9		180	
5		7		175	
6		4		170	
7	12	4			170
8		3		160	
9	6	3			160
10	12		165		
11	12	1			165
12	12		165		
13	12	10			165
14	6		160		
15	12		165		
16	12	5			165
17	2		150		
18		1		170	
19	3		160		
20	9		165		
21	9	7			165
22	12		165		
23	12	7			165
24	9		165		
25	9	1			165
26	3		165		
27	3	5			165
28	6		165		
29	6	10			165
30	2		160		
31	6		165		
32	9		170		
33	9	8			170
34	12		165		
35	6		170		
36		11		175	
37		4		174	
38	6	8			170
39	12		165		
40	6		170		
41		12		180	
42		4		171	
43	9	4			171
44	3		165		
45	2		170		
46		12		175	
47	9		172		
48	9	11			172
49	2		165		
50	12		170		
51		11		173	
52	6	11			173
53	6		165		
54		12		170	
55	2		171		
56	3		173		

YEAR 11

S.N.	Buyer	Seller	Bid	Offer	Price
1	11		160		
2		2		300	
3	9		165		
4	4	2			300
5		1		275	

6		6		250	
7		1		240	
8		12		230	
9		1		220	
10		12		210	
11		8		200	
12	12		165		
13		5		180	
14		10		170	
15	12	1			165
16		6		165	
17	12	6			165
18	3		165		
19	9		170		
20	9	5			170
21		10		170	
22	9	10			170
23	3		165		
24	3	1			165
25		10		170	
26	6	10			170
27	12		165		
28	9		170		
29	9	7			170
30		5		170	
31	12	5			170
32		11		175	
33		7		170	
34	12	7			170
35	6		170		
36		2		190	
37		12		185	
38	6	4			170
39	3		170		
40	3	4			170
41		2		190	
42	6		170		
43		8		174	
44	6	4			170
45	12		170		
46		2		180	
47		8		172	
48	9	8			172
49	12		170		
50		11		172	
51	6	11			172
52	12		170		
53		2		180	
54		8		173	
55	9		171		
56	9	2			171
57	6		170		
58		12		175	
59	9		171		
60	9	8			171
61	9		170		
62	6		171		
63	6	11			171
64	12		170		
65	9		172		

YEAR 12

S.N.	Buyer	Seller	Bid	Offer	Price
1	11		200		
2		1		400	
3	12		220		
4		6		395	
5	11		230		
6	12		240		
7	1		250		
8	12		300		
9	8		340		
10	10		390		
11	10	5			390
12	1		370		
13		6		395	
14		2		390	
15	10	2			390
16	7		390		
17		6		395	
18	7	6			395
19		3		400	
20		7		390	
21	12	7			390
22		3		395	
23	1	3			395
24		2		399	
25		12		395	
26	10	12			395
27		3		395	
28	1	3			395
29		11		398	
30		12		395	
31	10	12			395
32		12		395	
33	7	12			395
34		5		400	
35		6		395	
36	1	6			395
37		11		395	
38	1	11			395
39	1		390		
40		2		399	
41		5		395	
42	10	5			395
43		2		397	
44		9		395	
45	7	9			395
46		8		395	
47	10	8			395
48		9		397	
49	7		395		
50	1		396		
51	1	8			396
52	10		395		
53		2		398	
54	4	2			398
55		9		397	
56	1	9			397
57	4		399		
58		11		410	
59		11		405	
60	4	11			399

MARKET 4

YEAR 1

S.N.	Buyer	Seller	Bid	Offer	Price
1	7		1000		
2	7	1			1000
3		3		2000	
4		8		1500	
5	2	8			1500
6		11		1500	
7		9		1400	
8		11		1300	
9		7		1200	
10		11		1100	
11		7		1000	
12	3	7			1000
13		8		1000	
14	12	8			1000
15		11		1000	
16		1		950	
17	3		900		
18	3	7			900
19		11		800	
20		9		700	
21		1		600	
22		11		500	
23	8	11			500
24		9		500	
25		1		400	
26		4		350	
27		11		300	
28		4		275	
29		11		175	
30	12	11			175
31		7		500	
32		1		275	
33	3		150		
34		7		250	
35		1		225	

36	10		200		
37	10	9			200
38		7		300	
39		1		250	
40		7		225	
41	3		150		
42		1		220	
43		7		200	

YEAR 2

S.N.	Buyer	Seller	Bid	Offer	Price
1		11		1000	
2	3		100		
3		4		170	
4		7		700	
5		11		200	
6	3		150		
7	3	9			150
8		8		150	
9	1	8			150
10	3		125		
11		7		300	
12		2		250	
13		5		200	
14	1	5			200
15		2		225	
16		8		200	
17	7	8			200
18		11		200	
19	2		125		
20	3	11			200
21		7		250	
22		5		200	
23	10	5			200
24		11		200	
25		1		190	
26		11		180	
27	5	11			180
28		1		190	
29	3	1			190
30		2		200	
31		9		190	
32	10	9			190
33		7		200	
34		5		190	
35		2		150	
36	1	2			150
37		3		200	
38		5		185	
39	10	5			185
40		3		190	
41	7		150		
42		1		180	
43		1		170	
44	5	1			170
45		3		190	
46	2		125		
47	7		150		
48	1		160		
49		3		180	
50		5		175	
51	1	5			175
52		3		180	
53		3		175	
54	7	3			175

YEAR 3

S.N.	Buyer	Seller	Bid	Offer	Price
1	3		150		
2	3	1			150
3		11		200	
4	12		100		
5	2		125		
6	5		130		
7		9		190	
8		8		180	
9		1		170	
10	11		145		
11	5		150		
12	5	2			150
13	3		140		
14		11		150	
15	7	11			150
16		8		150	
17	1	8			150
18		11		150	
19	3	11			150
20		7		180	
21	3		140		
22		1		170	
23		5		160	
24	3		150		
25	3	9			150
26	2		145		
27		1		170	
28		7		160	
29		5		155	
30	1	5			155
31		8		150	
32	7	8			150
33		3		155	
34	1	3			155
35		7		160	
36	10		150		
37		3		155	
38	7	3			155
39	3		150		
40		1		160	
41	10		155		
42	10	1			155
43		7		160	
44	4		155		
45	4	3			155
46		1		160	
47	3		150		
48	10	1			160
49		7		160	
50	10	7			160
51		3		160	
52	10	3			160
53		1		170	
54		3		165	
55		1		160	
56		12		155	
57	1	12			155
58	3		150		
59	1		155		
60		3		160	

YEAR 4

S.N.	Buyer	Seller	Bid	Offer	Price
1		8		200	
2	3		150		
3		1		180	
4	4		155		
5	4	11			155
6		9		160	
7	2		155		
8	1	9			160
9		8		160	
10		12		155	
11	1	12			155
12		11		155	
13	1	11			155
14		8		155	
15	3	8			155
16	2		155		
17	2	8			155
18	9		155		
19	9	5			155
20		3		160	
21	1	3			160
22		5		160	
23	1		155		
24		2		158	
25	1	2			158
26		9		160	
27	2		150		
28	3		155		
29	3		158		
30	3	9			158
31	5		140		
32	2		150		
33	1		155		
34		5		170	
35		10		160	
36	3		157		
37	1	10			160
38		3		160	
39	1	3			160
40		9		160	
41	1	9			160
42		12		160	
43	3		158		
44	3	12			158
45		5		160	
46	10		150		
47	1		155		
48	3		157		
49	1		158		
50	1	5			160
51	3		160		
52		10		170	
53		7		165	
54	1	7			165

YEAR 5

S.N.	Buyer	Seller	Bid	Offer	Price
1	5		120		
2	11		130		
3		1		180	
4		3		170	
5	11		145		
6		1		165	
7		8		150	
8	5	8			150
9		9		160	
10	3		150		
11		1		155	
12	5	1			155
13		2		160	
14		8		155	
15	3	8			155
16		9		155	
17	4	9			155
18		1		155	
19	5	1			155
20		7		160	
21	11		145		
22	2		150		
23	3		155		
24	3	7			155
25	5		160		
26	5	7			160
27		9		160	
28	11		145		
29	5		155		
30	3		158		
31	5	9			160
32		2		160	
33		12		159	
34	11		150		
35	3		155		
36	3	2			155
37	11		155		
38		3		158	
39	12	3			158
40	7		150		
41	5		155		
42		3		158	
43	5	3			158
44	11		155		
45	5		160		
46	5	3			160
47	5		160		
48	5	3			160
49	11		155		
50	5		160		
51	5	3			160
52		12		160	
53	2		150		
54	11		155		
55	5	12			160
56	11		160		
57	11	10			160
58		12		160	
59	11	12			160

YEAR 6

S.N.	Buyer	Seller	Bid	Offer	Price
1	3		160		
2	1		170		
3	1	5			170
4	1		170		
5	1	8			170
6	3		180		
7		11		200	
8	3	5			180
9	9		180		
10	9	8			180
11	1		180		
12	1	2			180
13	7		180		
14	3		185		
15	1		190		
16	3		195		
17		12		200	
18	1	12			200
19	3		200		
20	3	11			200
21	3		200		
22	7		205		
23	1		210		
24	3		225		
25	9		230		
26	3		250		
27		10		280	
28	3	10			280
29	1		250		
30	3		280		
31	3	4			280
32	1		250		
33	7		255		
34	9		260		
35	3		280		
36	3	1			280
37	9		280		
38	9	7			280
39	3		280		
40	3	1			280
41	3		280		
42	3	4			280
43		10		290	
44		7		285	
45	3		280		
46		7		284	
47	3	1			280
48		3		280	
49		11		270	
50	7	11			270
51		12		275	
52	3	12			275
53		7		280	
54	3	7			280
55		10		290	
56	3		280		
57	3	1			280
58		7		285	
59	3		280		
60	3	7			280
61	3		280		
62	3	1			280
63	9		280		
64	9	1			280
65	3		280		
66		10		285	
67	3	10			285
68	3		280		
69	9		285		
70	3		290		
71	3		300		
72	3		325		
73	3		350		
74	3		360		
75	3	2			360
76	9		280		
77	3		300		
78	9		320		
79	3		350		
80	3		360		

YEAR 7

S.N.	Buyer	Seller	Bid	Offer	Price
1		7		300	
2		1		250	
3		9		200	
4	3		150		
5		1		190	
6		7		180	
7		8		175	
8		9		170	
9	5		160		
10	5	7			160
11		9		170	
12		8		160	
13	5		155		
14	5	8			155
15		9		160	
16	5		150		
17		1		155	
18	2	1			155
19	11		155		
20	11	1			155
21	5		160		
22	5	9			160
23	5		160		
24	5	7			160
25	8		150		
26	5		155		
27		3		160	
28	5	3			160
29		9		160	
30	5	9			160
31		2		160	
32	5	2			160
33		12		165	
34	5		160		
35	5	4			160
36		3		160	
37	5	3			160
38	8		150		
39	2		155		
40	5		160		
41	5	12			160
42	5		160		
43		10		180	
44		8		170	
45		10		165	
46	5	8			160
47	9		150		
48	2		155		
49	5		160		
50	5	4			160
51	9		155		
52	5		160		
53		10		170	
54		10		165	
55	5	10			165
56	5		165		
57		2		170	
58	5	2			170
59	11		155		
60	5		160		
61		10		170	
62	5	10			170

YEAR 8

S.N.	Buyer	Seller	Bid	Offer	Price
1		10		300	
2		8		200	
3		9		190	
4		3		180	
5	1		150		
6	5		155		
7		3		170	
8		7		165	
9		3		162	
10	5		160		
11	5	1			160
12	5		155		
13		7		165	
14		3		160	
15	5	3			160
16		9		165	
17	5		160		
18	5	9			160
19	5		160		
20	5	1			160
21	5		160		
22	5	3			160
23		7		165	
24	2		160		
25	5	7			165
26		10		170	
27	2		160		
28	5		165		
29	5	9			165
30		7		170	
31	5		165		
32		10		168	
33	5	10			165
34		7		170	
35	8		150		
36	2		155		
37	5		165		
38	5	12			165
39	5		165		
40		7		170	
41	8	7			170
42		2		175	
43	11		160		
44	5		165		
45		2		170	
46	5	2			170
47	8		150		
48	2		155		
49	11		160		
50	5		165		
51	5		170		
52		4		185	
53		8		175	
54		10		173	
55	5	10			170
56	5		170		
57		2		180	
58		8		175	

YEAR 9

S.N.	Buyer	Seller	Bid	Offer	Price
1	3		150		
2	9		160		
3		1		280	
4		11		270	
5	7	11			270
6		8		250	
7	7	8			250
8	3		250		
9	9		255		
10	4		260		
11		2		270	
12	9	2			270
13		8		275	
14	3	8			275
15		5		300	
16	3	5			300
17		7		320	
18		5		310	
19		11		300	
20	3	11			300
21		7		325	
22		1		300	
23	9	1			300
24		12		325	
25	3		300		
26	3	4			300
27		12		310	
28	3		300		
29	3	5			300

30	9		300		
31		7		310	
32	9	12			300
33	3		300		
34		7		325	
35		1		310	
36	9	1			310
37		7		320	
38	3		305		
39		10		315	
40		7		310	
41	9	7			310
42		2		315	
43	3		310		
44	3	7			310
45	3		310		
46	3	4			310
47	9		310		
48	9	2			310
49	3		310		
50		7		320	
51		10		315	
52	9		312		
53	3	10			315
54		7		320	
55	3		315		
56		7		319	
57	3	7			319
58	3		320		
59	3	7			320
60		12		320	
61	9	12			320
62	3		320		
63		10		325	
64	9	10			325
65	3		325		
66	3		330		
67	9		335		
68	3		340		

YEAR 10

S.N.	Buyer	Seller	Bid	Offer	Price
1		5		310	
2		3		250	
3		1		180	
4		4		175	
5	11		150		
6	11	1			150
7	2		150		
8		9		170	
9	5		160		
10	5	4			160
11	8		150		
12	5		160		
13	1		165		
14		7		175	
15		3		170	
16	1	4			165
17		9		180	
18		7		170	
19	2		160		
20	5		165		
21	5	10			165
22		9		170	
23	1		155		
24	2		160		
25		3		165	
26	5	3			165
27		9		170	
28	1		165		
29	5	9			170
30		2		180	
31		7		175	
32	1		160		
33	2		165		
34		7		170	
35	5	7			170
36		2		175	
37	8		160		
38	1		165		
39	5		170		
40	5	2			170
41		9		180	
42		7		175	
43	2		165		
44		9		170	
45	5	9			170
46	11		150		
47	2		155		
48		7		175	
49	8		160		
50	2		165		
51		1		170	
52	5	1			170
53	11		160		
54	2		165		
55		7		175	
56		1		170	
57	2		168		
58	5	1			170
59		7		175	
60	8		165		
61	11		~~170~~		
62	11	3			170
63		7		175	
64	5		170		
65		10		172	
66	5	7			170
67		12		175	
68	5		170		
69	5	12			170
70	8		170		
71	5		172		
72		10		180	
73		10		175	

YEAR 11

S.N.	Buyer	Seller	Bid	Offer	Price
1	3		160		
2	9		170		
3		5		320	
4		2		310	
5		10		300	
6	9		250		
7		8		280	
8	5	8			280
9	3		300		
10	3	2			300
11	3		300		
12	3	5			300
13	9		305		
14	9	11			305
15	3		305		
16	3	8			305
17	9		305		
18	9	4			305
19	3		305		
20		5		310	
21	3	5			310
22		1		330	
23		7		320	
24	9		310		
25	9	5			310
26	3		310		
27		7		320	
28	3	4			310
29	9		310		
30	3		320		
31	3	7			320
32	3		315		
33	9		320		
34	9	1			320
35	3		320		
36		2		325	
37	3	1			320
38	3		320		
39	3	2			320
40	9		320		
41	9	10			320
42	3		320		
43		12		330	
44		7		330	
45	3		325		
46	3	7			325
47	3		325		
48		12		330	
49	9	12			330
50	3		330		
51		10		340	
52	9		335		
53	3	10			340
54		12		375	
55	9		340		
56		11		370	
57	9		350		
58	9	11			350
59	3		355		
60	9		360		
61	3		365		
62	3	6			365
63	9		365		
64		12		375	
65	9		370		
66	9	12			370
67	9		360		
68	9		370		
69	9	6			370
70	3		370		

YEAR 12

S.N.	Buyer	Seller	Bid	Offer	Price
1	1		150		
2		9		200	
3	7		160		
4		1		190	
5		9		180	
6	8		165		
7		9		170	
8	2	9			170
9	1		170		
10		9		180	
11		2		175	
12	10	2			175
13	1		170		
14		2		180	
15		4		175	
16	1	4			175
17		9		185	
18		5		180	
19		7		175	
20	2		170		
21	1	7			175
22		5		180	
23	2		170		
24		7		175	
25	2	3			170
26		7		175	
27	5		170		
28		2		173	
29	5	3			170
30		2		175	
31	5		170		
32		2		173	
33	5	4			170
34	11		170		
35		1		180	
36		2		175	
37	5		172		
38	5	2			172
39		9		180	
40		7		175	
41	8		170		
42	8	6			170
43		7		175	
44	5		170		
45	5	9			170
46	8		165		
47		1		180	
48	2		170		
49		7		175	
50	2	1			170
51	8		160		
52	5		170		
53	5	7			170
54	8		165		
55		12		175	
56	5		170		
57	5	1			170
58	8		170		
59	8	10			170
60		2		175	
61	11	2			175
62		12		175	
63	5		170		
64	5	1			170
65		12		170	
66	5	12			170
67		10		175	
68	5		170		
69	5	10			170
70	5		170		
71		8		180	

YEAR 13

S.N.	Buyer	Seller	Bid	Offer	Price
1	9		200		
2	7		250		
3	3		300		
4		8		500	
5		2		450	
6		4		350	
7		5		340	
8	9		305		
9		4		310	
10	3	4			310
11		8		320	
12	1	8			320
13		2		330	
14	9		310		
15		2		320	
16	7	2			320
17	3		320		
18	9		325		
19	9	10			325
20	3		325		
21	9		330		
22	9	5			330
23	3		330		
24	3	4			330
25	3		325		
26		8		350	
27	9		330		
28		7		340	
29	9	8			330
30	3		330		
31		1		350	
32		7		340	
33	1	7			340
34		5		350	
35	9		330		
36	7		335		
37		2		345	
38	3		340		
39	3	1			340
40	9		340		
41		2		345	
42	9	5			340
43	9		340		
44		2		345	
45	9	1			340
46	3		340		
47		1		350	
48		2		345	
49	9	2			345
50	3		345		
51	3	1			345
52		11		370	
53	9		340		
54		1		360	
55	3		345		
56	3	11			345
57	9		345		
58		1		370	
59	3		350		
60	3	7			350
61	3		350		
62		1		360	
63	9		355		
64	3	1			360
65	9		360		
66		12		380	
67		11		370	
68	9		365		
69	9	7			365
70	3		365		
71	3	11			365
72	9		365		
73		12		375	
74		10		370	
75	9	10			370
76		12		375	
77	3		370		
78	3	12			370
79		12		380	
80	3		370		
81	9		372		
82		12		375	
83	3		373		
84	3	12			373
85	3		373		

YEAR 14

S.N.	Buyer	Seller	Bid	Offer	Price
1	10		130		
2	3		140		
3		1		250	
4	2		145		
5		1		180	
6	2		150		
7	9		155		
8		4		175	
9	3		160		
10		4		170	
11	2		165		
12	1	4			170
13		11		170	
14	2		165		
15	1	11			170
16		3		170	
17		5		165	
18	2	5			165
19	10		160		
20		2		170	
21		3		165	
22	1	3			165
23		11		165	
24	10	11			165
25		5		165	
26	9		160		
27	9	5			160
28		4		170	
29		9		165	
30		4		160	
31	1		150		
32	2		155		
33	2	4			155
34		9		165	
35		2		160	
36		1		155	
37	10		145		
38		8		150	
39	7	8			150
40		9		155	
41	3		150		
42	3	9			150
43		2		160	
44		8		155	
45	2	8			155
46		9		150	
47	1	9			150
48		12		165	
49		10		160	
50	3		150		
51		12		155	
52	2	12			155
53		7		155	
54	3	7			155
55		2		165	
56	1		150		
57		9		160	
58		10		155	

MARKET 5

YEAR 1

S.N.	Buyer	Seller	Bid	Offer	Price
1	12		100		
2	11		110		
3		12		150	
4	7	12			150
5		11		200	
6	2	11			200
7		3		200	
8		11		190	
9	11		110		
10	3		120		
11	8		125		
12	11		130		
13	9		150		
14		12		175	
15		11		170	
16	6		155		
17	9		160		
18	9	3			160
19		11		170	
20	6		150		
21		12		160	
22	7	12			160
23		11		170	
24	6		160		
25	6	10			160
26		1		165	
27	6		160		
28	6	3			160
29	8		150		
30	6		160		
31		11		170	
32	6	1			160
33	12		150		
34		11		170	
35	8		155		
36		1		165	
37	9	1			165
38	8		160		
39	4		165		
40	4	10			165
41	9		165		
42		11		170	
43	9	11			170
44	8		165		

YEAR 2

S.N.	Buyer	Seller	Bid	Offer	Price
1	11		130		
2	4		135		
3	6		165		
4	6	3			165
5		11		175	
6		12		170	
7	6		160		
8	7		165		
9	7	12			165
10	6		165		
11	6	2			165
12	8		165		
13		11		175	
14	6		170		
15	6	12			170
16		3		180	
17	6		160		
18		11		170	
19	8	11			170
20		1		175	
21	6		160		
22	8		165		
23		3		170	
24	6	3			170
25		4		170	
26	8	4			170
27		11		175	
28	2	11			175
29	6		170		
30		1		175	
31	5	1			175
32		4		180	
33	8		170		
34	6		175		
35	6	2			175
36		4		180	
37		1		175	
38	6	1			175
39		4		175	

40	8	4			175
41	8		170		
42	8		175		
43	8	2			175
44	6		175		
45	6	9			175
46	7		175		
47	7	10			175
48		8		180	
49	8		170		
50	6		175		
51	5	8			180
52	6		175		
53		8		185	
54		12		180	
55	6	9			175
56	8		170		

YEAR 3

S.N.	Buyer	Seller	Bid	Offer	Price
1	9		150		
2		3		200	
3		11		180	
4	2		160		
5	10		165		
6	8		170		
7	8	2			170
8	12		165		
9	6		170		
10		11		175	
11	7	11			175
12		3		190	
13		11		180	
14	6		170		
15	6		175		
16	6	4			175
17		11		180	
18	8		175		
19	8	12			175
20		4		175	
21	7	4			175
22		11		180	
23	6		175		
24	6	9			175
25		11		180	
26	8		175		
27	8	9			175
28		3		175	
29	8	3			175
30	12		175		
31		11		180	
32	12	8			175
33	6		175		
34	6	1			175
35	8		175		
36	8	2			175
37		12		180	
38	8		175		
39	8	12			175
40		3		175	
41	8	3			175
42		11		175	
43	7	11			175
44		12		175	
45	6	12			175
46		1		175	
47	8		170		
48	6	1			175
49	8		175		
50	8	10			175
51		5		180	
52	8		175		
53	8	10			175

YEAR 4

S.N.	Buyer	Seller	Bid	Offer	Price
1	12		170		
2		9		180	
3	7		175		
4	12	9			180
5	7		175		
6	7	8			175
7	6		175		
8	6	2			175
9		9		180	
10	7		175		
11	7	4			175
12		5		180	
13		9		179	
14		11		175	
15	7	11			175
16	6		175		
17	6	4			175
18	12		175		
19		11		180	
20	12	9			175
21	12		175		
22		11		180	
23	12	2			175
24		10		180	
25	12		170		
26		5		175	
27	12	5			175
28	12		170		
29		5		185	
30		10		180	
31	6		175		
32	6	11			175
33	12		175		
34		10		180	
35	12	3			175
36	12		175		
37		5		180	
38	12	10			175
39	12		175		
40	12	3			175
41	12		175		
42		5		180	
43	6	5			180
44		10		180	
45	12		175		
46	6		176		
47	6	10			176
48		12		180	
49	12		175		

YEAR 5

S.N.	Buyer	Seller	Bid	Offer	Price
1		9		180	
2	7		175		
3	7	4			175
4	11		150		
5	12		170		
6		11		180	
7		4		175	
8	7	4			175
9		10		180	
10	11		170		
11		9		175	
12	12	9			175
13		5		185	
14		10		180	
15		11		175	
16	12	11			175
17		9		175	
18	12	9			175
19		5		180	
20	12		170		
21		6		175	
22	12	6			175
23		11		180	
24		6		175	
25	2	6			175
26		3		175	
27	12	3			175
28		10		175	
29	12	10			175
30		5		180	
31	12		175		
32	12	11			175
33		3		180	
34		8		175	
35	12	8			175
36		5		180	
37	9		150		
38	2		170		
39	12		175		
40	12	5			175
41		5		175	
42	12	5			175
43		3		175	
44	12	3			175
45	9		150		
46	12		175		
47	12	10			175
48	12		175		
49		12		190	
50	12	8			175
51	12		175		
52		1		185	

YEAR 6

S.N.	Buyer	Seller	Bid	Offer	Price
1		12		175	
2	9	12			175
3		11		200	
4	4	11			200
5		3		250	
6	6	3			250
7	6		250		
8	6	2			250
9		8		275	
10	11		200		
11		8		270	
12		5		260	
13	12		210		
14	9		220		
15	4		230		
16		8		250	
17	9		240		
18	9	8			240
19		11		260	
20	9		240		
21		5		250	
22	9	11			240
23	12		235		
24	9		240		
25		1		250	
26	6	1			250
27		2		250	
28	10		235		
29	9		240		
30	9	12			240
31	9		240		
32		7		245	
33	9	8			240
34		3		250	
35	10		240		
36	10	7			240
37	9		240		
38		3		245	
39	9	2			240
40	6		240		
41	6	7			240
42	10		240		
43	10	3			240
44	9		240		
45		5		250	
46		1		245	
47	6	1			245
48	4		240		
49		10		250	
50	6		245		
51	6	5			245
52		5		250	
53	9		240		
54		5		245	
55	6	5			245
56	6		245		
57		10		250	
58	6	10			250
59		10		250	

YEAR 7

S.N.	Buyer	Seller	Bid	Offer	Price
1		9		175	
2	8	9			175
3		4		170	
4	5	4			170
5	12		170		
6		9		175	
7	8	9			175
8		3		250	
9	12		170		
10	11		175		
11		4		200	
12	5		180		
13		4		190	
14	5	4			190
15	11		180		
16	12		185		
17	12	2			185
18	8		185		

19		11		200	
20	5		190		
21		11		195	
22	8	11			195
23	12		185		
24		11		200	
25		10		195	
26	5	10			195
27	8		190		
28	8	7			190
29	6		190		
30	8		195		
31		11		200	
32	6	11			200
33		12		210	
34	8		200		
35	8	12			200
36	5		200		
37	5	7			200
38	8		200		
39	8	2			200
40	6		200		
41		12		210	
42	8		205		
43	8	10			205
44	8		200		
45		12		210	
46	6		205		
47	5	12			200
48	8		205		
49		1		210	
50	6	1			210
51	8		205		
52		12		220	
53	5		210		
54	8		215		
55	5	12			220
56		3		230	
57	6		220		
58	8	3			230
59	8		230		
60		1		240	
61	5	1			240
62	8		250		
63		3		270	
64	8	3			270
65	5		250		
66		8		275	
67	8		260		
68	6		265		
69	5		270		
70	6	8			275
71	8		275		
72	5		300		

YEAR 8

S.N.	Buyer	Seller	Bid	Offer	Price
1	12		200		
2		4		250	
3	5		210		
4	12		220		
5	1		225		
6	5	4			250
7		11		300	
8	5		250		
9		4		280	
10	5	6			250
11	12		250		
12		4	270		
13		7	260		
14	12	6		250	
15	1		250		
16	1	2			250
17	12		250		
18		7		260	
19	8	7			260
20	5		250		
21	12		260		
22	12	7			260
23	8		260		
24		4		270	
25	8	4			270
26	12		260		
27		2		275	
28	5		270		
29	8	2			275
30		12		280	
31	8		270		
32		1		275	
33	5	1			275
34		11		280	
35	8	11			280
36		12		280	
37	8	12			280
38		1		285	
39	8		280		
40	8	~~10~~			280
41		11		290	
42	8		280		
43		12		285	
44	5	12			285
45		1		285	
46	5	1			285
47		11		290	
48	8	11			290
49		10		300	
50		12		295	
51		10		290	
52	8	10			290
53		1		295	
54	8		285		
55		12		290	
56	8	12			290
57		1		295	
58		9		290	
59	5	9			290
60		12		300	
61		1		290	
62	8	1			290
63	8		290		
64		12		310	
65		9		300	
66		3		295	
67	5	3			295
68		9		295	
69	8	9			295
70		12		295	
71	5	12			295
72		3		320	
73		3		300	
74	6		290		
75		3		295	
76	8	3			295
77	8		295		

YEAR 9

S.N.	Buyer	Seller	Bid	Offer	Price
1	12		170		
2	11		180		
3		4		295	
4	1		185		
5		5		250	
6	12		210		
7	9		220		
8	11		230		
9	9		240		
10	9	12			240
11		11		250	
12	9		240		
13	9	2			240
14		11		250	
15	1	11			250
16		8		250	
17	10		240		
18	11		245		
19	7	8			250
20		5		260	
21		12		255	
22		6		250	
23	10		240		
24		5		245	
25	10	6			240
26	9		240		
27		12		250	
28		11		245	
29	9	2			240
30	9		240		
31		12		245	
32	9	6			240
33		10		240	
34	9	10			240
35		5		250	
36		12		245	
37	9		235		
38		11		240	
39	10	11			240
40		12		240	
41	9		235		
42	9	7			235
43		3		240	
44	9		230		
45		7		235	
46	10	7			235
47		1		235	
48	4	1			235
49		12		240	
50	9		235		
51	9	7			235
52	4		235		
53		3		250	
54		12		240	
55	9	12			240
56		1		240	
57	10	1			240
58	9		240		
59		5		245	
60	9	8			240
61	4		240		
62		3		245	
63	4	5			240
64	10		240		
65	10	3			240
66		1		240	
67	9	1			240
68		3		250	
69	9		235		
70	10		240		
71		5		245	
72	10	3			240
73	9		240		
74	9	5			240
75	4		240		

YEAR 10

S.N.	Buyer	Seller	Bid	Offer	Price
1	9		200		
2	11		210		
3		5		270	
4	11		220		
5	9		235		
6		11		250	
7	12		240		
8	12	2			240
9	1		240		
10		8		250	
11		12		245	
12	1	~~6~~			240
13	9		240		
14	9	11			240
15		6		240	
16	9	6			240
17		11		240	
18	10	11			240
19		7		240	
20	10		230		
21	9		235		
22	4	7			240
23	9		240		
24	9	12			240
25	4		240		
26	4	8			240
27	9		240		
28	9	12			240
29	10		240		
30	10	7			240
31		12		240	
32	9	12			240
33	10		240		
34		1		245	
35	10	8			240
36	4		240		
37	4	2			240
38	10		240		
39		1		245	
40	10	5			240
41	9		240		
42	9	1			240
43	10		240		
44		5		245	
45	10	1			240
46	10		240		
47	10	3			240
48	4		240		
49		1		245	
50	4	3			240

51	9		240		
52	9	1			240
53	10		240		
54		5		245	
55	10	5			240
56	9		240		

YEAR 11

S.N.	Buyer	Seller	Bid	Offer	Price
1		11		300	
2		6		280	
3	9		150		
4	11		175		
5	9		200		
6	11		210		
7		5		250	
8	11	8			210
9	9		210		
10	9	12			210
11	11		200		
12	11	6			200
13		5		210	
14		4		200	
15	11		150		
16	12		170		
17		4		190	
18		8		180	
19	12		175		
20	12	6			175
21		9		175	
22	1	9			175
23		10		180	
24	12		175		
25	12	7			175
26	1		175		
27	1	8			175
28	12		175		
29	12	4			175
30	11		175		
31		10		180	
32	11	4			175
33	1		175		
34	1	7			175
35	12		175		
36	12	9			175
37	1		175		
38	1	10			175
39	11		175		
40	11	10			175
41	12		175		
42		5		180	
43	12	9			175
44	1		175		
45	1	3			175
46	12		175		
47	12	5			175
48	2		175		
49		3		190	
50	12	5			175
51	11		175		
52		3		185	
53	12		176		
54		3		180	
55	12	3			176
56	2		175		
57	12		176		

YEAR 12

S.N.	Buyer	Seller	Bid	Offer	Price
1	9		200		
2		11		300	
3		8		250	
4		5		245	
5	12		230		
6	9		235		
7		11		240	
8	9	11			240
9	10		235		
10		11		240	
11	9	11			240
12		7		240	
13	9	7			240
14		7		240	
15	9	7			240
16		6		240	
17	10	6			240
18		8		240	
19	10	8			240
20		2		240	
21	9	2			240
22		12		240	
23	10	12			240
24		6		240	
25	9	6			240
26	10		240		
27	10	12			240
28	10		240		
29	10	2			240
30	4		235		
31	10		240		
32	10	1			240
33	9		240		
34		5		245	
35	10		241		
36		1		243	
37	10	5			241
38	9		240		
39	9	3			240
40	10		240		
41	10	8			240
42	4		240		
43	4	3			240
44	10		240		
45	10	1			240
46	9		240		
47	9	5			240
48	10		240		

YEAR 13

S.N.	Buyer	Seller	Bid	Offer	Price
1		11		300	
2	12		240		
3	8		250		
4		4		290	
5	12		255		
6	7		260		
7	11		270		
8	5		275		
9		12		285	
10	6		280		
11	8	12			285
12	6		280		
13		9		285	
14	5	9			285
15	6		285		
16		11		290	
17	8	11			290
18	7		285		
19		2		290	
20	5	2			290
21		4		290	
22	6	4			290
23		1		295	
24	6		290		
25	6	2			290
26	7		290		
27		11		300	
28	6		295		
29	6	1			295
30		9		295	
31	7	9			295
32		4		290	
33	6	4			290
34	12		290		
35		11		300	
36	7		295		
37	7	12			295
38		10		300	
39	5		295		
40	5	1			295
41		10		300	
42	6		295		
43	8	10			300
44		11		300	
45	6	11			300
46		10		300	
47	7	10			300
48		3		320	
49	7		300		
50	6		305		
51	5		310		
52	6		315		
53	6	3			315
54	6		310		
55		3		320	
56	6		315		
57	6	3			315
58	6		310		

STOP

FOOTNOTES

* The financial support of the National Science Foundation, Coopers and Lybrand Foundation, and the Caltech Program for Enterprise and Public Policy is gratefully acknowledged. We have benefited from many conversations with Robert Forsythe and James Jordan. We would also like to thank Stanley Reiter whose comments led to experiment 5.

1. Any buyer (seller) is free at any time to make an oral bid (offer) to buy (sell) one unit of the security at a designated price. Such bids and offers are publicly announced and recorded. Only one (the last) bid and offer are outstanding at any time. Sellers (buyers) are free to accept any public bid (offer) they wish.

2. Even though individuals were trained, we still had no way of knowing their subjective probabilities.

3. Market 1: periods 6, 8; market 2: periods 7,9; market 3: periods 3, 5, 7, 8, 10; market 4: periods 5, 7, 8, 10, 12; market 5: periods 4, 5, 11.

4. Buy and Hold: Buy one certificate at opening price of each period; liquidate at closing price of the period.

Trend Filter: Observe price trend from opening to current price; if positive, buy if necessary to hold one certificate; if negative, sell if necessary to maintain a short position of one certificate. Liquidate at closing price.

y-Franc Filter: If price goes up by y or more francs, buy if necessary, to hold one certificate until the price goes down by y or more francs, at which time sell, if necessary, to maintain a short position of one certificate until the price goes up again by y or more francs. Liquidate at closing price.

5. Any time current price is below the equilibrium price, hold a long position of one certificate by buying at the current price if necessary; any time the current price is above the equilibrium level, hold a short position of one certificate by selling, if necessary.

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